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PACIFIC OCEANIC FISHERY
INVESTIGATIONS

PYCNOGONIDA

By

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Assistant-Keeper in the Department of Zoology,
British Museum (Natural History)

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PYCNOGONIDA

By Isabella Gordon, D.Sc., Ph.D.
British Museum (Natural History)

(Text-figs. 1–75)

INTRODUCTION

The Pycnogonida collected by the Royal Research Ships 'Discovery', 'Discovery II' and 'William Scoresby' during the years 1925–31 far exceed in number and variety those obtained by any previous Antarctic Expedition.[1] Sixty-five species are represented, all, with two exceptions, from the Western Antarctic and sub-Antarctic area. Of these, fifteen species are described as new, a proportion of one in four approximately. One genus is new and two (*Pallene* and *Nymphopsis*) are new to the area in question. Many of the specimens of *Decolopoda*, *Colossendeis* and *Ammothea* are of unusually large size. One feature of the collection is the abundance of minute forms, testifying to the excellence of the method of using fine nets in conjunction with trawl or dredge. None of the new species is of outstanding morphological or systematic interest, and the study does not add much of phylogenetic importance. It may well be that, while future expeditions will add to the number of species and to our knowledge of their geographical distribution, the present conception of the Antarctic pycnogonidan fauna (from shallow water) will not be materially altered.

My best thanks are due to Prof. Ch. Gravier, of Paris, Dr A. Burr, of Strasbourg, and Dr A. Panning, of Hamburg, who did all in their power to further my studies during brief visits to the respective museums. A number of the commoner forms in the earlier collection (1925–7) were identified by Dr W. T. Calman, F.R.S., before I began this study, but I am entirely responsible for the final determinations as well as for all the conclusions arrived at in this report. I am under particular obligations to Dr Calman for his helpful criticism and encouragement.

A number of the drawings were prepared by Miss Joyce Townend; the others are outline sketches drawn with the camera lucida.

NOTES ON OCCURRENCE AND DISTRIBUTION

A list of the Antarctic and sub-Antarctic species represented is given, together with other data, in the following table (pp. 4, 5).

As regards the numbers of individual specimens, out of a total exceeding 1800, at least 1200 belong to the single genus *Nymphon*. Of these, three-fourths belong to the two most common species *N. australe* (500 +) and *N. charcoti* (300 +); two other forms

---

[1] See Calman, 1915, p. 1.

List of species* from Antarctic and sub-Antarctic waters in the Discovery collection	Number† of specimens	Number of stations at which collected	Months when males carry ova or larvae	Magellan District	South Georgia	South Orkneys and Clarence Island	South Sandwich Islands	South Shetlands and further South	Bouvet Island	Previously recorded from Kerguelen, Gauss winter-quarters or Ross Sea area
Family DECOLOPODIDAE										
Decolopoda australis, Eights.	11	8	...	...	×	...	...	×	...	...
antarctica, Bouvier	7	6	...	...	×	×	...	...	...	...
Family COLOSSENDEIDAE										
Colossendeis scotti, Calman	4	2	...	...	×	...	...	...	...	R
tortipalpis, n.sp.	3	1	...	...	...	×	...	...	...	...
australis, Hodgson	10	4	...	...	...	×	×	×	...	R
frigida, Hodgson	38	13	...	×	×	...	×	×	...	R
scoresbii, n.sp.	16	5	...	×	...	...	...	...	...	...
wilsoni, Calman	1	1	...	...	...	×	...	...	...	R
glacialis, Hodgson	19	11	...	...	×	×	×	...	...	G, R
drakei, Calman	3	1	...	×	...	×	...	...	...	R
Family NYMPHONIDAE										
Pentanymphon antarcticum, Hodgson	11	4	...	...	...	×	×	×	...	G, R
Nymphon proceroides, Bouvier	34	4	...	...	...	...	...	×	...	...
tenuipes, Bouvier	7	2	...	...	...	...	...	×	...	...
hiemale, Hodgson	30	10	XII–III	...	×	×	...	...	...	R
gracillimum, Calman	1	1	...	...	×	...	...	...	...	R
subtile, Loman	7	4	VII	×	...	...	...	...	...	...
pfefferi, Loman	10	4	...	...	×	...	...	...	...	...
paucidens, n.sp.	13	5	I	...	×	...	...	...	...	...
charcoti, Bouvier	300+	14	XII–III	...	×	×	...	...	...	R
clarencei, n.sp.	7	3	II	...	×	×	...	...	...	...
sp. ? St. 181	1	1	...	...	...	...	...	×	...	...
sp. ? St. 53	1	1	...	×	...	...	...	...	...	...
australe, Hodgson	500+	16	XII–II	...	×	×	×	×	×	R
orcadense, Hodgson	100	2	II	...	...	×	...	...	...	...
articulare, Hodgson	5	1	...	...	...	×	...	...	...	...
neumayri, n.sp.	9	1	...	...	...	...	...	×	...	...
brevicaudatum, Miers	100	23	XII–I	...	×	×	...	×	...	...
biarticulatum, Hodgson	30	6	...	...	...	×	...	×	...	K, R
bouvieri, n.sp.	4	1	...	...	...	...	...	×	...	...
multidens, n.sp.	1	1	...	...	...	...	...	...	×	...
Heteronymphon kempi, g. et sp.n.	7	5	...	...	×	...	...	...	...	...
Family PHOXICHILIDAE (PALLENIDAE)										
Pallene margarita, n.sp.										

brachyura (Bouvier)	2	2	...	...	×	...	...	×	...	R
cristata (Bouvier)	1	1	...	...	×	...	...	...	...	G
Family Phoxichilidiidae										
Pallenopsis pilosa (Hoek)	17	8	...	...	...	×	...	×	×	G, R
patagonica (Hoek)	55	21	III–IV [A]: VII [M]	×	×	×	...	×	...	R
spicata, Hodgson	1	1	...	...	...	×	...	...	...	G, R
Phoxichilidium australe, Hodgson	6	3	III	...	...	×	...	×	...	G, R
Family Endeidae										
Endeis australis (Hodgson)	1	1	III	...	...	...	...	×	...	...
Family Ammotheidae										
Ammothea striata (Möbius)	1	1	...	...	...	×	...	...	...	...
gigantea, n.sp.	3	1	III	...	...	...	×	...	...	...
tetrapora, n.sp.	6	2	VII	×	...	...	...	...	...	...
longispina, n.sp.	1	1	...	...	...	×	...	...	...	...
spinosa (Hodgson)	2	2	VII	×	...	...	...	...	...	R
minor (Hodgson)	5	5	...	...	×	...	×	×	...	R
calmani, n.sp.	1	1	...	...	...	...	...	×	...	...
stylirostris, n.sp.	2	1	...	...	...	×	...	...	...	...
sp. ? WS 216	1	1	...	×	...	...	...	...	...	...
carolinensis, Leach	5	5	...	...	×	...	...	...	...	...
clausi, Pfeffer	16	10	...	×	...	...	×	...	...	...
Achelia hoekii (Pfeffer)	3	1	...	...	...	...	...	×	...	...
intermedia, Calman	8	2	...	...	? ×	...	×	...	...	R
brucei, Calman	5	2	...	...	×	...	...	...	...	R
serratipalpis, Bouvier	8	1 (? 2)	III	...	...	...	...	×	...	...
parvula, Loman	150	2	...	×	...	...	...	...	...	...
Austroraptus polaris, Hodgson	1	1	...	...	...	×	...	...	...	G, R
praecox, Calman	2	1	...	...	×	...	...	...	...	R
juvenilis, Calman	7	5	...	...	×	...	×	×	...	R
Austrodecus glaciale, Hodgson	16	13	...	×	×	...	...	...	...	G, R
Tanystylum styligerum, Miers	14	1	...	×	...	...	...	...	...	K
pfefferi, Bouvier‡	25	4 (+ 2)‡	X–XII	×	×	...	...	...	×	...
Rhynchothorax australis, Hodgson	1	1	...	×	...	...	...	...	...	G, R
Nymphopsis denticulata, n.sp.	1	1	...	×	...	...	...	...	...	...
Family Pycnogonidae										
Pycnogonum rhinoceros, Loman	1	1	...	...	×	...	...	...	...	...
platylophum, Loman	2	2	...	×	...	...	...	...	...	...
magellanicum?, Loman§	4	1 (+ 1)§	...	×	...	...	...	...	...	...

---

* In addition to the species listed *Nymphon angolense*, n.sp., was represented by thirty specimens from a single station off the coast of Angola, males ovigerous in VII (July); and an immature specimen of a pelagic species of *Pallenopsis* was obtained off South Africa.

† Where the total number of specimens exceeds fifty, a rough but conservative estimate is given.

‡ Three specimens from (1) Gough Island, and (2) Tristan da Cunha have been referred, with some hesitation, to this species: a ♂ from the former locality was ovigerous in VI (June).

§ Two specimens from Gough Island are referred provisionally to this species; the ♂ was ovigerous in V (May).

are each represented by about 100 individuals, namely *N. orcadense* and *N. brevicaudatum*. The remaining species of the genus are, as a rule, represented by single specimens or by very small numbers. The family Ammotheidae is represented by over 300 specimens, but, with the exception of *Achelia parvula*, no species is represented by more than twenty-five specimens. Twenty-four species were each obtained only at a single station and all in small numbers. As against this *Nymphon brevicaudatum* occurred at twenty-three, and *Pallenopsis patagonica* at twenty-one stations.

The depths at which Pycnogonida were obtained rarely exceeded 500 and were usually between 2 and 350 m.

With regard to geographical distribution, the majority of the species were collected in the Glacial District of the Antarctic Zone[1] (Palmer Archipelago to South Georgia, the South Sandwich Islands and Bouvet Island); a considerable number occurred only in the Magellan District of the sub-Antarctic Zone, and a few species were found in both districts (see table, pp. 4, 5).

The 'Discovery' has done very extensive collecting in the neighbourhood of South Georgia, and the 'William Scoresby' concentrated on the neighbourhood of the Falkland Islands (Magellan District). Although the former is not so very far south of the latter group of islands, the pycnogonidan fauna apparently differs considerably. Of the nineteen species from the Magellan District only six[2] are also represented from South Georgia and one from the South Orkneys. One species, *Colossendeis scoresbii*, may prove to be a northern form[3] of *C. frigida*, which, though most commonly found in the Glacial District, is also present in the Magellan District (pp. 4, 5).

Of the four species collected beyond the northern limits of the sub-Antarctic Zone, two are very near to, if not identical with, sub-Antarctic forms (*Tanystylum pfefferi* and *Pycnogonum magellanicum* (?) from Gough Island and Tristan da Cunha).

Twenty-seven of the Antarctic and sub-Antarctic species have also been recorded from the Ross Sea Area, ten from Kaiser Wilhelm Land and two from the Kerguelen District (see table, pp. 4, 5). It is highly probable that the majority of these forms will prove to be circumpolar in their distribution.

The decapodous species *Pentapycnon charcoti*, collected by the 'Pourquoi-Pas?' off the South Shetlands, has not been rediscovered, although Dr S. Kemp was on the look-out for it.

Breeding season. Ovigerous or larvigerous males of sixteen species were obtained. As far as one can judge, in the absence of records covering all months of the year, the breeding season (assuming that there is a definite season) differs in Antarctic and in sub-Antarctic or Temperate waters. In the Antarctic Zone males were carrying ova or larvae from October to April, usually from December to March (table, pp. 4, 5). In the Magellan District all the ovigerous and larvigerous males were collected in July. In one instance only (*Pallenopsis patagonica*), ovigerous males were collected from both regions, and here also there is a difference of three months (March and April in Antarctic waters, July in the Magellan District). Antarctic specimens of *Tanystylum pfefferi* were carrying ova from October to December, while an ovigerous male referred to the same species was collected off Gough Island in June. Only a few records from South Temperate and Tropical waters are available and these are for the period May to July.

---

[1] See map given by Regan (1914, fig. 2, p. 25).

[2] *Nymphon orcadense* has also been recorded from South Georgia, in addition to those listed.

[3] Similarly *Nymphon biarticulatum* may prove to be a more southern form of the common *N. brevicaudatum* (p. 72).

VARIATION AND SPECIFIC CHARACTERS

Dr Calman (1915, p. 6) divided the Pycnogonida into two categories distinguished as follows. "Certain genera and families present large numbers of minutely separated species, the distinguishing characters of which have at least the appearance of inconstancy; while other groups are composed of few species easily and sharply defined by characters that are relatively invariable." The first category is by far the larger, and I have found considerable variation also in two genera hitherto regarded as monotypic, namely *Pentanymphon* and *Austrodecus*. On the other hand the five species of *Ammothea* described as new each appear to be characterized by several distinctive, sharply defined features, although these also may prove to be liable to considerable variation when more material is available.

The larger genera belonging to the first category, e.g. *Colossendeis*, *Pallenopsis* and especially *Nymphon*, present, as every student of the group is well aware, many systematic difficulties and problems. Previous writers have sometimes taken considerable pains to provide keys to facilitate the task of specific determination, but no one seems to have undertaken a really comprehensive study of the specific characters. Since each succeeding collection includes some new, or apparently new, forms, the multiplication of species cannot profitably be continued until a thorough revision of each genus is first undertaken. This would necessitate, in addition to a re-examination of all the available types of known species, a study of the amount of variation within each species. Frequently the available number of individual specimens is far too small to admit of this. Some knowledge of the post-larval development would also prove most useful, but at present very little is known even in the more common forms. There is some evidence to show that, for example, the relative proportions of tarsus and propodus (often used to distinguish between closely allied species) differ considerably in young and adult specimens of certain species (*Colossendeis scoresbii* and *Pentanymphon antarcticum*).

The key to the determination of the "Longitarsal" species of the genus *Colossendeis* (p. 11) is little more than an extended and slightly modified edition of that previously given by Dr Calman (1915, pp. 10–11). That drawn up for the determination of the Antarctic species of the genus *Ammothea* (p. 95) is almost entirely new; as many of the specific characters as possible have been included in the key, which thus incorporates the results of what may be regarded as a preliminary revision of these species. Most of the forms included in this report are now, it is hoped, adequately described and figured, but many species not represented in the Discovery collections are still in need of revision.

I found it impossible to be certain of the identification of many of the numerous *Nymphon* species until I had re-examined the types of nearly every species previously recorded from the Antarctic and sub-Antarctic Zones. This revision probably constitutes the most important part of the paper. Species re-examined but not represented in the present collection have been described and figured in a separate short paper.[1] The results of this study have been condensed into a synoptic key (p. 31) to the determination of the adult males, and a table (p. 28). Many of the species are known from one or a very few specimens and several from the adult female only. Even when the known species had been re-examined, the interpretation of the results was by no means easy. The species appeared to fall into two fairly well-defined groups according to the form of the oviger in the adult male. Each main group could again be subdivided, for the most part, into smaller sections comprising 2–4 or more closely related forms, although an occasional form was apparently quite isolated. When the whole genus can be revised, the results of the present study may have to be considerably modified. I am aware that another worker might possibly have arrived at a quite different interpretation of the relationships of the species, but I hope the classification given here will prove to be a step in the right direction.

SYSTEMATIC ACCOUNT

Family DECOLOPODIDAE

Genus **Decolopoda**, Eights

Decolopoda australis, Eights (Fig. 73 A).

Bouvier, 1913, p. 48, *ubi bibl.*

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock, 179–235 m.; gy. M. Large otter trawl: 1 ♂ (with Brachiopod attached).

St. MS 68. 2. iii. 25. East Cumberland Bay, South Georgia, 1·7 miles S ½ E to 8½ cables SE × E of Sappho Point, 220–247 m. Large rectangular net: 1 ♂ (colour in life—bright orange on legs; body, chelophores, palps and ovigers brown-red).

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point, to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 2 ♂♂ (1 with Brachiopod attached).

St. 142. 30. xii. 26. East Cumberland Bay, South Georgia, from 54° 11′ 30″ S, 36° 35′ W to 54° 12′ S, 36° 29′ 30″ W, 88–273 m. Large otter trawl: 2 ♀♀.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, from 54° 03′ S, 36° 39′ W to 54° 05′ S, 36° 36′ 30″ W, 132–148 m.; gy. M. St. Large otter trawl: 1 ♂.

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock, 200–234 m. Large otter trawl: 1 ♀ (with small patches of Polyzoa on limbs).

---

[1] Gordon, 1932.

St. 154. 18. i. 27. Jason Harbour to Larsen Point, South Georgia, from 2·6 miles S 84° W to $5\frac{1}{2}$ cables S 26° E of Larsen Point, 60–160 m. Large otter trawl: 2 ♀♀ (smooth legs—1 with small growth of encrusting Polyzoa on oviger).

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ S, 58° 28′ 30″ W, 391 m.; M. St. Medium otter trawl: 1 ♀ (spiny legs).

REMARKS. Bouvier (1913, p. 49) states that in the female the trunk is narrower and less discoidal than in the male. In the Discovery specimens the reverse is the case, the ratio of width across the second lateral process to length of trunk being 0·85–0·92 in the male and 0·92–1·01 in the female.

The accompanying table shows how this species differs from *D. antarctica*, Bouvier.

Table I

D. australis	*D. antarctica*
$\dfrac{\text{W. across 2nd lateral processes}}{\text{L. of trunk*}} = \begin{cases} 0{\cdot}85\text{–}0{\cdot}92 \text{ in ♂} \\ 0{\cdot}92\text{–}1{\cdot}01 \text{ in ♀} \end{cases}$	= 0·96–1·00 in ♂ and ♀ (0·88 in one ♂)
Palp 9-jointed	8–10-jointed
Shorter, thicker 1st joint to chelophore:	Longer, more slender
(*a*) $\dfrac{\text{L. of 1st joint}}{\text{L. of trunk}} = 0{\cdot}50\text{–}0{\cdot}65$	(*a*) = 0·66–0·75
(*b*) $\dfrac{\text{L. of 1st joint}}{\text{W. of 1st joint†}} = 4{\cdot}0\text{–}5{\cdot}3$	(*b*) = 6·0–8·0
Tibiae of 4th leg somewhat shorter:	Tibiae, especially the 2nd, somewhat longer:
(*a*) $\dfrac{\text{L. of tibia 1}}{\text{L. of femur}} = 1{\cdot}0\text{–}1{\cdot}04$	(*a*) = 1·05–1·08
(*b*) $\dfrac{\text{L. of tibia 2}}{\text{L. of femur}} = 1{\cdot}04\text{–}1{\cdot}13$	(*b*) = 1·22–1·33
Somewhat shorter proboscis, as a rule:	Somewhat longer proboscis:
$\dfrac{\text{L. of proboscis}}{\text{L. of trunk}} = 1{\cdot}15\text{–}1{\cdot}37$ (1·44 in 1 specimen)	= 1·38–1·54
Palm relatively short; fingers strongly arched	Palm relatively long, fingers but slightly arched
Ocular tubercle narrow, less than half width of cephalon	Ocular tubercle exceeding half width of cephalon

* To anterior end of abdomen.

† Near base.

DISTRIBUTION. The two species of the genus *Decolopoda* have been recorded only from the western side of the Glacial District of the Antarctic Zone. It is interesting to note that both forms appear to have nearly the same range, since both have been recorded from South Georgia and the South Orkneys, *D. australis* from the South Shetlands and the type of *D. antarctica* from Graham Land.

Decolopoda antarctica, Bouvier (Figs. 1, 73 B, C and 74 *b*).

Calman, 1920, p. 244, *ubi bibl.*

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock, 179–235 m.; gy. M. Large otter trawl: 1 ♂ with all claws much worn (Brachiopod attached, and small groups of an encrusting Polyzoon on ventral surface).

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m. Large otter trawl: 1 ♀, with some encrusting Polyzoa and a Serpulid.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 1 ♂ (whole ventral surface covered by a sponge with wide sockets left for movement of ovigers; left chela covered by an encrusting Polyzoon and a similar growth commencing on movable finger of right chela).

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 1 ♀ (various encrusting Polyzoa on body and legs; pyriform mass of *Alcyonidium* on two terminal segments of right palp).

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock, 200–234 m. Large otter trawl: 1 ♂, 1 ♀ (several encrusting Polyzoa and a sponge on ventral surface of ♀).

St. 164. 18. ii. 27. E end of Normanna Strait, South Orkneys, near Cape Hansen, Coronation Island, 24–36 m. Small beam trawl: 1 ♂ (encrusting Polyzoa and several adherent Foraminifera).

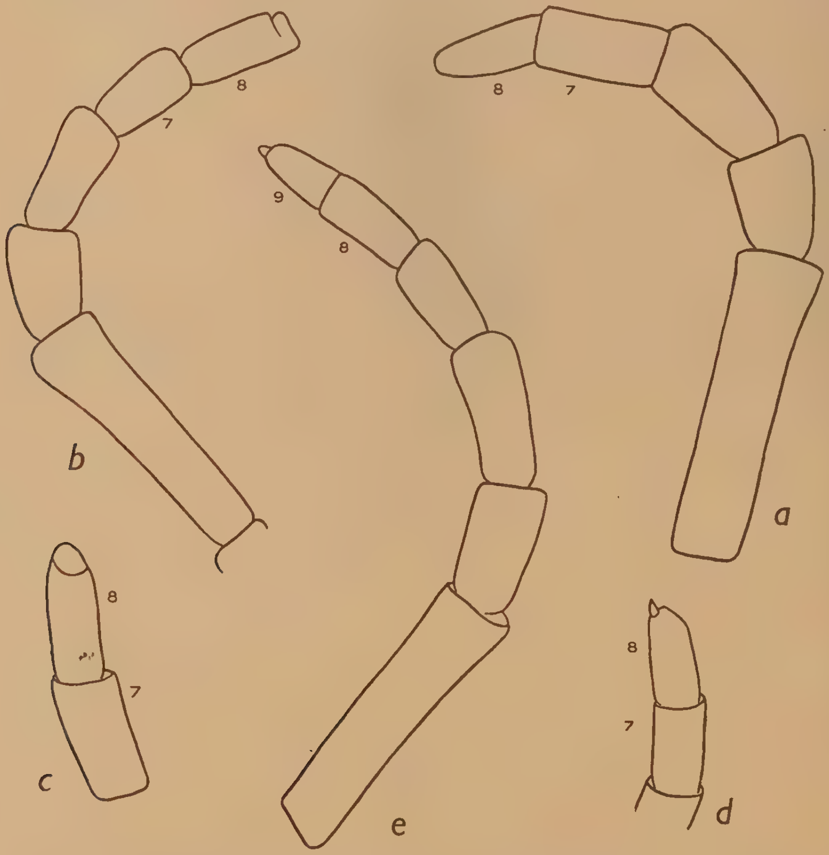

Fig. 1 *a–e*. *Decolopoda antarctica*, Bouvier. To illustrate variation in the total number of segments of the palp: × 8.

REMARKS. Bouvier (1913, p. 50; 1906, pp. 27–9) has enumerated the differences between *D. australis* and the holotype of *D. antarctica*, but now that more specimens of the latter are available, it becomes evident that certain of these differences are no longer valid.

In *D. antarctica* the number of segments in the palp is variable (8–10, see Table I, Fig. 1; Calman, 1920, p. 245, figs. A and B). This extreme variability is most unusual in Pycnogonida, where the palp has, as a rule, a constant number of segments in each species. Since it is not yet certain that this is a quite normal phenomenon, it has been dealt with under "Abnormalities" (p. 130).

According to Bouvier (1906, p. 28) the legs are considerably longer in *D. antarctica*, being approximately twelve times the maximum width of the trunk instead of only 8–9 times as in *D. australis*. In the Discovery specimens the two species are alike in this respect, for while the ratio varies from 9·3 to 12·8, the average is 10·84 for *D. australis*, 10·90 for *D. antarctica*.

In *D. antarctica* the two sexes do not differ from each other with regard to the relative width of the trunk (Table I). The chief differences between the two species are given in Table I; the outstanding characteristics of *D. antarctica* are (1) the broad ocular tubercle, (2) the slightly arched fingers, and (3) the long, slender first joint of the chelophore.

Encrusting organisms, mostly Polyzoa and sponges, are found with far greater frequency on specimens of *D. antarctica*, suggesting that it is probably of more sluggish habits than *D. australis* (see p. 132). In the male from St. 123 the left chela is rendered quite useless by a growth of Polyzoa, and in the specimen from St. 140 the ocular tubercle is partially concealed.

DISTRIBUTION. See p. 4.

Family COLOSSENDEIDAE, Hoek

Genus **Colossendeis**, Jarzynsky

Two species are described as new, although, when more material is available, one of these may prove to be a sub-Antarctic form of a common Antarctic species. The other species is remarkable for the lateral articulation between the seventh and eighth palpal segments.

The key to the "Longitarsal" species of *Colossendeis* drawn up by Calman (1915, pp. 10–11) is reprinted below with slight modifications, chiefly those required by the incorporation of the two new species.

I. Sixth segment of palp more than three times as long as wide.
  A. Proboscis distinctly longer than trunk.
    I. Trunk segmented..*C. articulata*, Loman
    II. Trunk non-segmented.
      A. Lateral processes in contact.
        1. Seventh segment of palp longer than eighth; eyes absent...*C. proboscidea* (Sabine)
        2. Seventh segment of palp shorter than eighth; eyes present......*C. scotti*, Calman

B. Lateral processes separated.

1. Eighth segment of palp articulated laterally with seventh *C. tortipalpis*, n.sp.

2. Eighth segment of palp normally articulated with seventh.

a. Seventh segment of palp equal to eighth .... *C. australis*, Hodgson; *C. media*, Hoek; *C. brevipes*, Hoek

b. Seventh segment of palp distinctly shorter than eighth.

i. Eyes absent.

α. Proboscis dilated distally ....*C. orcadensis*, Hodgson

β. Proboscis dilated in middle .... *C. angusta*, Sars; *C. gracilis*, Hoek

ii. Eyes present.

α. Legs smooth .... *C. megalonyx*, Hoek[1]; *C. frigida*, Hodgson

β. Legs spiny...*C. rugosa*, Hodgson

B. Proboscis subequal to trunk [claw subequal to propodus].....................*C. scoresbii*, n.sp.

II. Sixth segment of palp not more than twice[2] as long as wide [proboscis, at most, hardly longer than trunk].

A. Lateral processes in contact ....*C. wilsoni*, Calman

B. Lateral processes separated.

I. Femur longer than second tibia.

A. Sixth segment of palp longer than seventh, eighth or ninth ...*C. glacialis*, Hodgson (*C. gracilipes*, Bouvier)

B. Sixth segment of palp subequal to seventh, but shorter than either eighth or ninth ....*C. drakei*, Calman

II. Femur not longer than second tibia.

A. Lateral processes separated by their own diameter.....................*C. robusta*, Hoek

B. Lateral processes separated by less than their own diameter ......*C. lilliei*, Calman

Colossendeis scotti, Calman.

Calman, 1915, pp. 10 and 11, fig. 1.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m; M. Large otter trawl: 1 ♂, 1 ♀.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point, to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 1 ♂, 1 ♀.

DISTRIBUTION. Previously recorded from Ross Sea.

Colossendeis tortipalpis, n.sp. (Figs. 2 *b–e*, 3 *b*, *d* and 4 *a*).

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 1 ♀ (holotype), 1 ♂ and 1 immature, soft specimen, with *C. australis*.

DIAGNOSTIC CHARACTERS. Sixth palpal segment more than three times as long as thick; eighth palpal segment articulated laterally (or termino-laterally) with seventh; proboscis as a rule exceeding 1·5 times the length of the non-segmented trunk; lateral processes separated; eyes present; sub-chelate termination to tenth joint of oviger; tarsus approximately equal to, claw shorter than propodus.

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[1] *C. frigida*, *C. megalonyx* and *C. rugosa* may be co-specific; and *C. scoresbii* may be only a more northern form of this species.

[2] The sixth palpal segment may be rather more than twice as long as wide in *C. drakei*.

Description. Greatest width of *trunk*, across the first lateral processes, just under two-thirds of its length; lateral processes separated by approximately half their own diameter. Ocular tubercle high, conical; eyes, especially the anterior pair, well developed.

Proboscis decurved, over 1·5 times as long as trunk; narrow and cylindrical for the first third of its length, expanding to nearly twice this width in the centre, then gradually narrowing anteriorly; terminal just a little greater than basal width (Fig. 3 *d*).

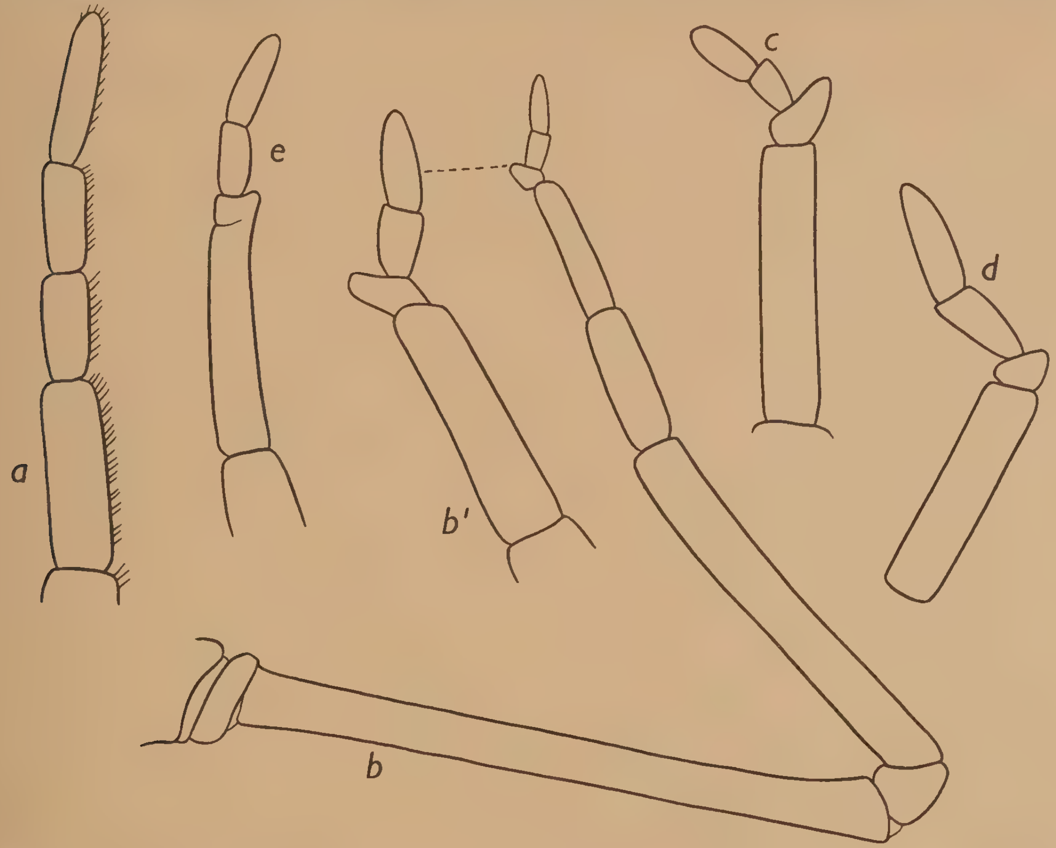

Fig. 2. Palp or four terminal palpal segments of: *a. Colossendeis australis*, Hodgson: ×11. *b–e. C. tortipalpis*, n.sp. (*b* and *c*, of male: ×11 and 20; *d*, of holotype: ×20; *e*, of immature specimen—slightly abnormal: ×17).

Abdomen short, extending to within a short distance of the distal articulation of the first coxa; narrow and cylindrical proximally, expanding considerably at about two-thirds of its length; apex bifid.

Palp as represented in Fig. 2 *b*; length of second exceeding 1·5 times that of fourth joint; fifth and sixth joints approximately equal; eighth joint laterally articulated with seventh and somewhat shorter than the terminal one.

Oviger with fourth slightly longer than sixth segment; spines on the four terminal segments in four rows; a large curved spine at the distal end of terminal segment opposed to the claw (Fig. 4 *a*).

Legs approximately six times as long as trunk; several rows of minute spines—the median dorsal row being most conspicuous—on femur and both tibias; only an occasional spine on tarsus and propodus (Fig. 3 *b*). The species, like *C. australis*, is characterized by the presence of a semicircle of 4–8 spines placed ventrally at the distal extremity of the second tibia and of the tarsus (see Fig. 3 *a* and *b*); a few smaller spines occur also at the distal articulation of the first tibia.

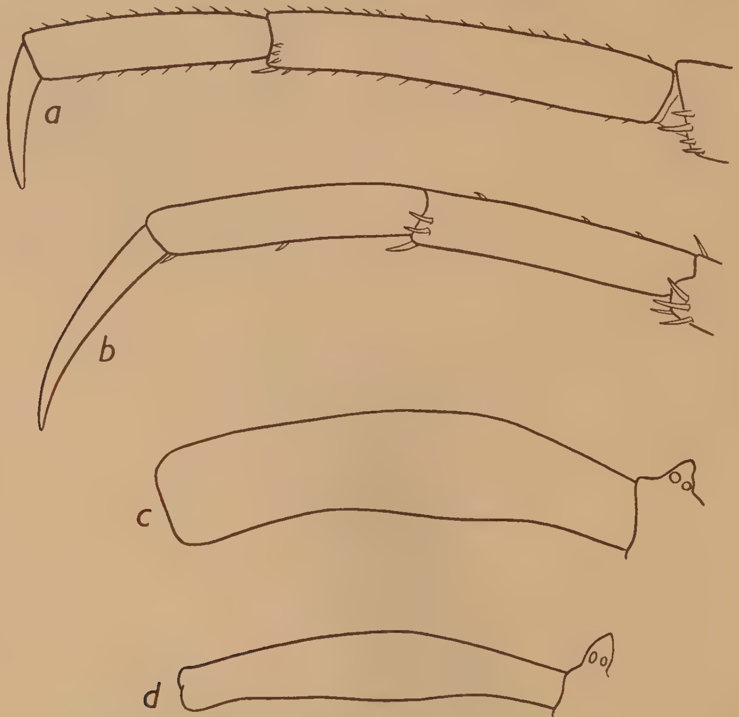

Fig. 3. *Colossendeis australis*, Hodgson: *a*. Terminal segments of third leg: × 8. *c*. Proboscis, lateral view: × 4.
Colossendeis tortipalpis, n.sp. *b*. Terminal segments of third leg: × 10. *d*. Proboscis, lateral view: × 3.

The genital openings of the male are not very distinct and perhaps are not yet perforate; those of the female are very conspicuous.

Measurements (mm.)

	Holotype ♀	♂	Immature
Length of proboscis	20·1	15·5	12·5
Greatest diameter of proboscis ...	3·7	2·7	2·0
Length of trunk	11·4	9·0	7·7
Width across first lateral process	6·9	5·7	5·0
Length of abdomen	3·1	2·5	2·0
Third leg:			
Coxa	6·5	5·3	4·5
Femur	20·0	13·6	11·0
First tibia	19·0	13·8	11·2
Second tibia	17·0	11·2	9·4
Tarsus	6·7	4·4	3·8
Propodus	6·0	4·4	3·8
Claw	5·5	3·2	3·1

REMARKS. The subchelate termination of the oviger places this species near to *C. scotti*, Calman, and *C. australis*, Hodgson.[1] It resembles the latter in having the lateral processes separated, but differs from it, and from most previously described species,[2] in the lateral articulation of the eighth palpal joint. This method of articulation is apparently normal, occurring in both palps of the holotype and of the male (Fig. 2 *b*, *c* and *d*; the seventh segment is longer in both the smaller specimens than in the holotype). In the immature specimen the left palp is normal; but the right one is abnormal (Fig. 2 *e*) in that the seventh segment appears to be absent, although there is perhaps a hint of a suture near the distal extremity of the sixth joint.

C. tortipalpis differs further from *C. australis* in the following respects: (1) it is a smoother, more slender form, (2) the proboscis is more tapering and graceful (cf. Fig. 3 *c* and *d*), (3) the sub-terminal spine on last segment of oviger is more strongly developed (cf. Fig. 4 *a* and *b*), and (4) the tarsus is much shorter, while the claw is longer (cf. Fig. 3 *a* and *b*).

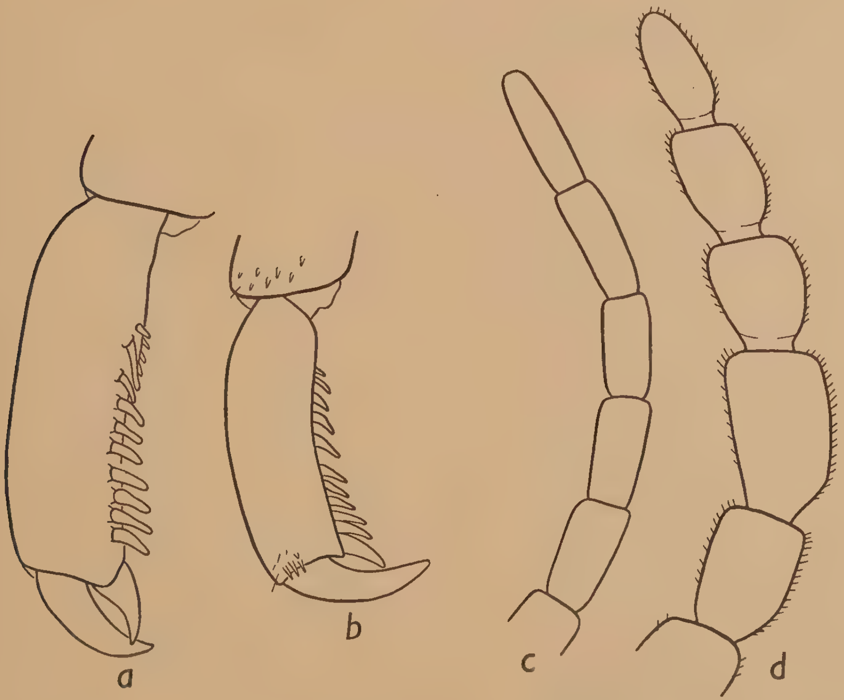

Fig. 4. Terminal segment of oviger with claw of: *a. Colossendeis tortipalpis*, n.sp.: × 36. *b. C. australis*, Hodgson: × 10.
Terminal segments of palp of: *c. C. drakei*, Calman: × 20. *d. C. glacialis*, Hodgson: × 15.

Colossendeis australis, Hodgson (Figs. 2 *a*, 3 *a*, *c* and 4 *b*).

Hodgson, 1907, p. 59, pl. ix, fig. 1; pl. x, figs. 1 and 2.
Bouvier, 1913, p. 63, text-figs. 20 and 21.
Calman, 1915, pp. 10 and 14.

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[1] The position that the species occupies in the key, using different characters, points to the same relationship.

[2] See Hoek, 1881, pl. ix, fig. 7, *C. gracilis*.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 7 specimens (2 soft), genital apertures very obscure.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W, 160–335 m. Large otter trawl: 1 ♀ (very scabrous).

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 1 specimen (encrusted with Polyzoa).

St. 599. 7. i. 31. 67° 08′ S, 69° 06½′ W, 203 m. Large dredge: 1 specimen (very soft).

Distribution. Eastern and Western Antarctic Zone.

Colossendeis frigida, Hodgson (Figs. 5 *a*, *b*, 6 *a*, *d* and 7 *c*, *d*).

Hodgson, 1907, p. 63, pl. ix, fig. 3; pl. x, figs. 5 and 6.
Calman, 1915, pp. 11 and 17.
Loman, 1923, p. 7.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E to 4 miles N 39° E of Jason Light, 120–204 m.; M. Large otter trawl: 1 specimen, with *Nymphon charcoti*.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 1 ♂.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W, 155–178 m.; gn. M. S. Large otter trawl: 1 ♂.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, from 54° 03′ S, 36° 39′ W to 54° 05′ S, 36° 36′ 30″ W, 132–148 m.; gy. M. St. Large otter trawl: 2 ♀♀, 1 ♂ (colour of the latter, "pale horn colour throughout, with distal extremities of ovigerous legs and true legs tinged with reddish").

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock, 200–234 m.; M. Large otter trawl: 1 ♀, 1 young.

St. 167. 20. ii. 27. Off Signy Island, South Orkneys, 60° 50′ 30″ S, 46° 15′ W, 244–344 m.; gn. M. Large otter trawl: 1 ♀, probably young.

St. 180. 11. iii. 27. 1·7 miles W of N point of Gand Island, Schollaert Channel, Palmer Archipelago, 160–330 m.; M. St. Large otter trawl: 1 specimen, probably ♀.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W, 160–335 m.; M. Large otter trawl: 1 ♀, 2 ♂♂.

St. 187. 18. iii. 27. Neumayer Channel, Palmer Archipelago. 64° 48′ 30″ S, 63° 31′ 30″ W, 259 m; M. Large dredge: 4 specimens—probably 2 ♀♀, 2 ♂♂.

St. 366. 6. iii. 30. 4 cables S of Cook Island, South Sandwich Islands, 77–152 m. Large otter trawl: 15 specimens.

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 2 specimens.

St. WS 245. 18. vii. 28. 52° 36′ S, 63° 40′ W, 304–290 m.; d. gn. S. Sh. Commercial otter trawl: 3 specimens.

St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, 210–242 m.; f. gn. S. Sh. Commercial otter trawl: 1 specimen.

Remarks. The specimens referred to *C. frigida*, Hodgson, are characterized as follows: (1) they are of large size and slender build (the trunk is usually 9–12 mm. long and the legs vary from nine to thirteen times the trunk length), (2) the second tibia is usually at least four-fifths of the femur, the tarsus is considerably longer and the claw shorter than the propodus (see Table II), (3) the proboscis in adult specimens is always at least half as long again as the trunk.[1]

The terminal claw of the oviger varies greatly in length (Fig. 5 *a* and *b*) and what Hodgson (1907, p. 64) terms the "thin membranous fold" is not always present.[2] The seventh palpal segment varies considerably in length, sometimes it is only as long, sometimes more than twice as long, as wide.

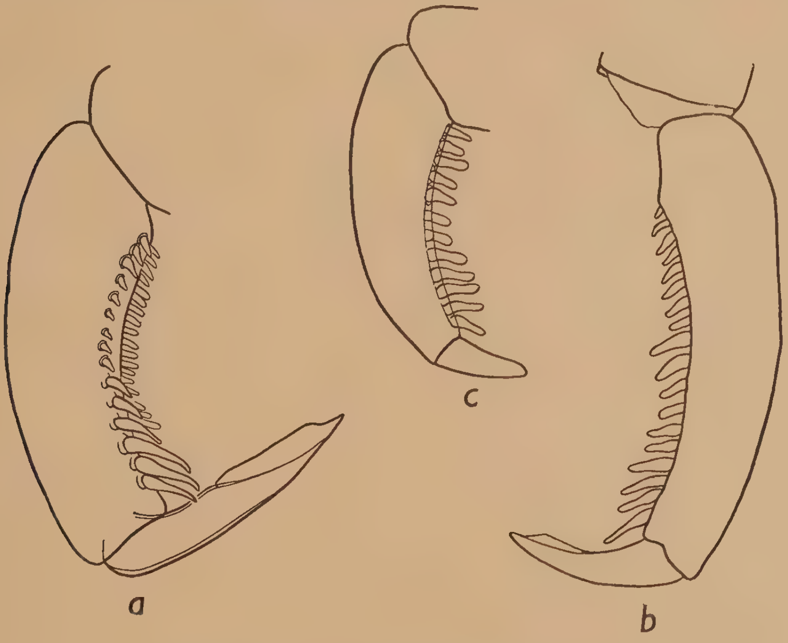

Fig. 5. Terminal segment of oviger with claw of: *a* and *b*. *Colossendeis frigida*, Hodgson: × 36. *c*. *C. scoresbii*, n.sp.: × 46.

The syntypes of *C. frigida*, from the other side of the Antarctic, are slightly more robust, with rather shorter legs (8·66–11 times the trunk length). The holotype of *C. megalonyx*, Hoek, agrees closely with the syntypes of *C. frigida* (see Table II); some of the other specimens, however, are intermediate between *C. frigida* and *C. scoresbii* (p. 21 and Table II). As suggested by Loman (1923, p. 7) *C. megalonyx*, *C. frigida* and *C. rugosa* may be co-specific, and *C. scoresbii* may prove to be just a smaller Northern form of *C. frigida* (p. 21). In that case the species would have to be called by Hoek's name—*C. megalonyx*.

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[1] The proboscis was rather shorter than is typical in two small specimens of 6·8 and 7·6 mm. trunk length respectively, being 1·45 and 1·27 times the trunk.

[2] The claw may be much worn in adults where the special spines on segments 7–10 are reduced to short stumps.

Table II

	Syntypes of *C. frigida*	Syntypes of *C. rugosa*		Discovery collection		Challenger collection *C. megalonyx*			
		Length (mm.)		*C. frigida*	*C. scoresbii*	Length (mm.)			
		8·51	9·8			11·0	8·0	7·3	7·0
$\frac{\text{L. of proboscis}}{\text{L. of trunk}}$	1·75–2·03	1·59	2·14	1·57 –2·39	0·94–1·19	1·82	1·69	1·40	1·30
L. of second tibia*	8·02–9·29	7·63	8·23	7·43†–9·14	5·90–7·00	7·8	8·0	6·58	6·90
L. of tarsus*	4·68–5·03	3·29	4·62	3·92 –4·89	2·25–3·18	4·51	4·66	3·26	2·76
L. of propodus*	3·62–4·00	2·75	3·27	3·20 –3·80	2·25–3·56	3·51	3·93	2·63	2·62
L. of claw*	1·78–2·27	2·33	2·31	1·72 –2·96	3·00–4·32	3·08	3·62	2·50	2·48
$\frac{\text{L. of tarsus}}{\text{L. of propodus}}$	1·20–1·37	1·20	1·41	1·17‡–1·46	0·94–1·09	1·28	1·20	1·24	1·16
$\frac{\text{L. of claw}}{\text{L. of propodus}}$	0·49–0·58	0·85	0·71	0·54 –0·79	1·00–1·35	0·88	0·92	0·95	0·95
Distribution	Antarctic—Ross Sea	Antarctic—Ross Sea		Antarctic§ (S. Georgia—to Palmer Archipelago)	Sub-Antarctic (Magellan District)	Sub-Antarctic (Magellan District)			

* Length of femur regarded as 10.
† Usually greater than 8.
‡ Usually greater than 1·2.
§ A few sub-Antarctic (Magellan District).

Colossendeis scoresbii, n.sp. (Figs. 5 *c*, 6 *b*, *c* and 7 *a*, *b*).

C. megalonyx, Hoek, 1881, p. 67, in part.

St. WS 91. 8. iv. 27. 52° 53′ 45″ S, 64° 37′ 30″ W, 191–205 m.; f. d. S. Sh. Commercial otter trawl: 2 young specimens and 1 larva with chelophores.

St. WS 92. 8. iv. 27. 51° 58′ 30″ S, 65° 01′ W, 143–145 m.; f. d. S. St. Commercial otter trawl: 1 ♂, 1 ♀, 6 young, of which 2 are soft, and 2 larvae with chelophores.

St. WS 93. 9. iv. 27. 7 miles S, 80° W of Beaver Island, West Falkland Island, 130–133 m.; gy. S. Commercial otter trawl: 2 ♀♀.

St. WS 98. 18. iv. 27. 49° 54′ 15″ S, 60° 35′ 30″ W, 173–171 m.; f. d. S. Commercial otter trawl: 1 ♀, holotype.

St. WS 245. 18. vii. 28. 52° 36′ S, 63° 40′ W, 304–290 m.; d. gn. S. Sh. Commercial otter trawl: 2 specimens with *C. frigida*.

DIAGNOSTIC CHARACTERS. Sixth palpal segment at least three times as long as wide, seventh segment shorter than either eighth or ninth which are subequal; proboscis subequal to trunk length; lateral processes separated; eyes present; terminal claw of oviger short, less than one-third of tenth segment; tarsus subequal to, claw as a rule longer than, propodus.

DESCRIPTION OF HOLOTYPE. *Trunk* non-segmented; greatest width across first lateral processes two-thirds of its length; second and third lateral processes separated by their own diameter.

Ocular tubercle high, distal half narrow and sharply conical; anterior much larger than posterior pair of eyes.

Proboscis scarcely longer than trunk; narrow and cylindrical in proximal third, expanding in centre to 1·5 times, and again at apex to 1·25 times the proximal diameter.

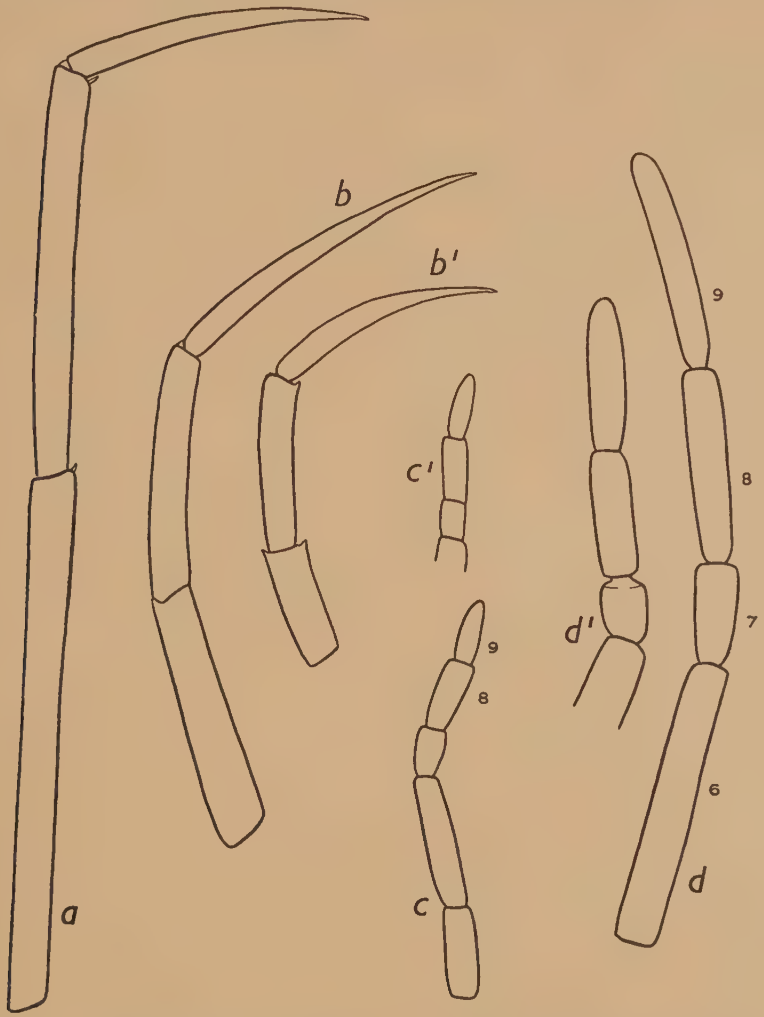

Fig. 6. *Colossendeis frigida*, Hodgson: *a*. Terminal segments of third leg of a young specimen from St. 149. *d* and *d'*. Terminal segments of palp. *C. scoresbii*, n. sp.: *b*. Terminal segments of third leg of adult from St. WS 93. *b'*. Same of chelophorous larva from St. WS 92. *c* and *c'*. Terminal segments of palp. (*a*, *b* and *b'*, × 11; *c*–*d'*, × 13.)

Abdomen reaching to distal articulation of first coxa.

Palp. Second more than half as long again as fourth segment; terminal segments as represented in Fig. 6 *c* and *c'*.

Oviger. Fourth and sixth segments subequal; seventh rather longer, tenth rather shorter than either of the two intervening segments; terminal claw short; spines in principal row of seventh segment relatively wider than the corresponding ones in *C. frigida* (Figs. 5 *c* and 7 *a*, *b*).

Legs six or seven times as long as trunk, slender and smooth; proportions of the three longest segments 5 : 4 : 3; tarsus subequal to, claw one-third as long again as propodus (Fig. 6 *b* and Table II); genital openings conspicuous.

Larva. The chelophorous larva from WS 91 measures 7 mm. in total length (including proboscis and abdomen). The legs possess a few longish slender spines along the mid-dorsal surface of each of the three main segments. These spines are all quite long in the immature specimens accompanying the larva, but are greatly reduced in size in the holotype. The tarsus is relatively shorter[1] than in adults but the terminal claw is longer than the propodus.

The chelophore is rather shorter than the propodus, with a two-jointed scape and the palm longer than the claws. The oviger is already well developed and the palp has the full number of segments although the terminal ones are relatively shorter than in the adult. The proboscis is equal in length to the trunk and of almost uniform diameter throughout its length. The lateral processes are less widely separated than in the adult and the abdomen reaches to the middle of the second coxa.

REMARKS. This species rather upsets the balance of the key to the "Longitarsal" species of *Colossendeis* given by Calman (1915, p. 10), because the proboscis is subequal to the trunk as in the second group, while the sixth palpal segment is relatively long and narrow as in the first group.

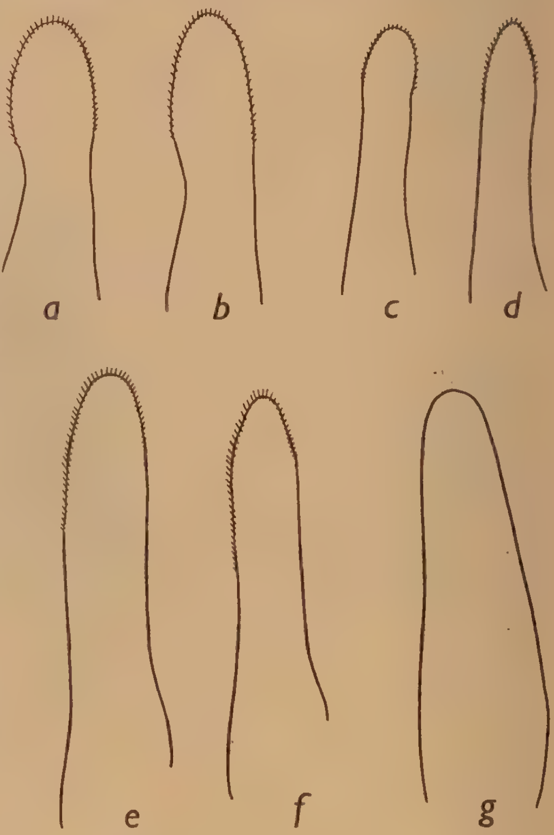

Fig. 7. Spines from principal row of seventh segment of oviger of: *a* and *b*. *Colossendeis scoresbii*, n.sp. *c* and *d*. *C. frigida*, Hodgson. *f*. *C. drakei*, Calman. *g*. *C. glacialis*, Hodgson.

e. Spine from principal row of tenth segment of oviger of *C. drakei*, Calman.

The specimens referred to *C. scoresbii* are readily distinguishable from all the specimens referred to *C. frigida*, Hodgson. They are of smaller size, with shorter walking legs; the proboscis is much shorter; the spines on the four terminal segments of the oviger are broader; second tibia and tarsus are both shorter relative to the length of the femur (see Table II) and the claw is much longer.

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[1] In immature forms the tarsus is sometimes relatively short, the propodus relatively long; as growth proceeds the former elongates more rapidly than the latter segment. See also *Pentanymphon antarcticum*, p. 26.

One of the Challenger specimens referred to *C. megalonyx* by Hoek undoubtedly belongs to *C. scoresbii*. Of the remaining four specimens (Table II) two[1] are very near to, and are probably, as Loman (1923, p. 7) has suggested, identical with *C. frigida*. The other two are intermediate between *C. frigida* and *C. scoresbii* (see Table II). No intermediate forms were included in the Discovery collection, but should such forms prove to be common in the Magellan District, it may yet be necessary to unite *C. megalonyx*, *C. frigida* and *C. scoresbii*.[2] It is to be regretted that the present collection does not contain any chelophorous larvae of *C. frigida* for comparison with those of *C. scoresbii*. In the latter species the proboscis is subequal to the trunk in the larva as well as in the adult; it would be interesting to know whether in the larva of *C. frigida*, the proboscis is short or long relative to the trunk, and whether the tarsus is longer relative to the propodus than in *C. scoresbii* (Fig. 6 *b′*).

DISTRIBUTION. Sub-Antarctic, north and west of Falkland Islands (Magellan District).

Colossendeis wilsoni, Calman.

Calman, 1915, pp. 11 and 18, fig. 2.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 1 ♂, with Scalpellum and ? pupa.

REMARKS. This specimen agrees with the description of the holotype except in one minor point, namely that the terminal segment of the palp is as long as the preceding or seventh segment. The right palp is mutilated.

DISTRIBUTION. Previously recorded from off Cape Adare.

Colossendeis glacialis, Hodgson (Figs. 4 *d*, 7 *g* and 8 *a*).

C. glacialis, Hodgson, 1907, p. 61, pl. ix, fig. 2; pl. x, figs. 3 and 4.
C. gracilipes, Bouvier, 1911, p. 1137; 1913, pp. 58–63, figs. 12–19.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock, 179–235 m.; gy. M. Large otter trawl: 1 ♀, "pale buff with legs banded with crimson on either side of each joint".

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m; M. Large otter trawl: 1 ♂ with small patch of an encrusting Polyzoon.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, from 54° 03′ S, 36° 39′ W to 54° 05′ S, 36° 36′ 30″ W, 132–148 m.; gy. M. St. Large otter trawl: 1 ♀ with patches of an encrusting Polyzoon on the body. The specimen is accompanied by the following note (Note 101): "'Harlequin' Pycnogon. Horn colour throughout, with scarlet red markings as follows: A few faint streaks on either side of

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[1] The claw is longer, but otherwise the specimens agree with the syntypes of *C. frigida*.

[2] Two possible explanations of the relationship of the forms from the American side of the Antarctic and sub-Antarctic Zones suggest themselves. *C. frigida* and *C. scoresbii* may be northern and southern forms of one species; or there may be two distinct species which may tend to inter-breed when the southern (*C. frigida*) enters the locality of the more northern one (*C. scoresbii*).

proboscis. A spot near distal end of proximal segment of palp. A lateral stripe on abdomen between legs. Legs with dorsal patch on first 3 segments; two bands on 4th and 5th segments, one in basal and one in distal third; 6th and 7th segments except for small patch at distal end; 8th segment with proximal half red; claw horn-coloured".

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N $76\frac{1}{2}$° W to 2·62 miles S 11° W of Merton Rock, 200–234 m.; M. Large otter trawl: 4 specimens (2 soft), probably all ♀♀. "Harlequin" Pycnogon. Small patches of an encrusting Polyzoon on the hard specimens.

St. 155. 18. i. 27. 4·1 miles S, $26\frac{1}{2}$° E of Larsen Point, South Georgia, 260 m.; M. Large otter trawl: 1 ♂ with small patches of encrusting Polyzoa on body and legs.

St. 156. 20. i. 27. 53° 51′ S, 36° 21′ 30″ W, 200–236 m.; R. Large dredge: 1 ♀.

St. 158. 21. i. 27. 53° 48′ 30″ S, 35° 57′ W, 401–411 m.; R. Large dredge: 1 ♀ "Harlequin" Pycnogon.

St. 160. 7. ii. 27. Near Shag Rocks, 53° 43′ 40″ S, 40° 57′ W, 177 m.; gy. M. St. R. Large dredge: 1 ♀ (genital apertures very prominent).

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 5 specimens, 1 with a small Lamellibranch, 1 with a very small Scalpellum, several with encrusting Polyzoa.

St. 363. 26. ii. 30. 2·5 miles S 80° E of SE point of Zavodovski Island, South Sandwich Islands, 329–278 m.; Sc. Large dredge: 2 specimens.

St. 366. 6. iii. 30. 4 cables S of Cook Island, South Sandwich Islands, 77–152 m. Large otter trawl: 1 specimen.

REMARKS. The striking colour of this species in the living condition led the collectors to give it the name of "Harlequin" Pycnogon (see St. 148). Traces of the red markings are still apparent in a few of the specimens.

In small specimens, although the genital apertures are present, it is not easy to distinguish the sexes. In adult females the genital opening is situated obliquely on a round, blunt eminence that is very conspicuous in some specimens (e.g. from St. 160).

Colossendeis drakei, Calman (Figs. 4 *c*, 7 *e*, *f* and 8 *b*).

Calman, 1915, pp. 11 and 22, fig. 3.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 2 specimens, probably ♀♀, but genital apertures rather obscure.

St. WS 245. 18. vii. 28. 52° 36′ S, 63° 40′ W, 304–290 m.; d. gn. S. Sh. Commercial otter trawl: 1 specimen.

DESCRIPTION. *Trunk* non-segmented, lateral processes separated by approximately their own diameter. Ocular tubercle conical; eyes, especially anterior pair, well developed.

Proboscis a trifle shorter than trunk, diameter at distal end approximately 1·5 times that at base and rather *greater* than that in the centre.

Abdomen short, reaching to middle of first coxa, considerably expanded in centre.

Palp with second slightly longer than fourth segment; fifth, sixth and seventh segments subequal and each rather shorter than eighth or ninth.

Oviger with fourth joint equal to sixth; terminal claw half as long as tenth segment; spines in principal row on each of the four distal segments relatively broader than in

C. glacialis, and serrated distally like those of *C. frigida*, *C. megalonyx* and *C. scoresbii*, n.sp. (Fig. 7 *e* and *f*).

Legs slender, without spines; claw equal to or slightly shorter than propodus which is only a little shorter than tarsus (see Fig. 8 *b*).

Surface of body and limbs destitute of spines or spinules but uniformly covered with minute setae.

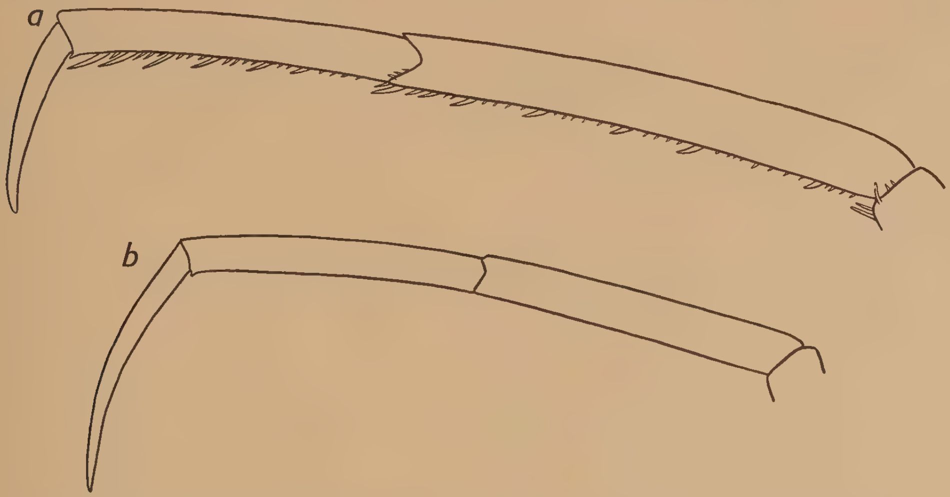

Fig. 8. Terminal segments of third leg of: *a*. *Colossendeis glacialis*, Hodgson, paratype. *b*. *C. drakei*, Calman, holotype (both × 11).

Measurements (*mm.*)

Length of proboscis	6·3	5·5
Greatest diameter of proboscis (at apex)	1·4	1·4
Length of trunk	6·5	6·0
Width across lateral processes	4·5	4·0
Length of abdomen	1·7	1·5
Third right leg:		
Coxa	3·8	3·6
Femur	13·0	11·0
First tibia	11·1	9·6
Second tibia	9·5	8·0
Tarsus	4·2	3·8
Propodus	4·0	3·5
Claw	3·7	3·5

REMARKS. These specimens are most nearly related to *C. glacialis*, Hodgson, but differ from that species in the following respects: (1) they are of more slender build without the spinules on body and legs characteristic of *C. glacialis*, (2) the tarsus is shorter, the claw longer and there are no spines on the legs (cf. Fig. 8 *a* and *b*), (3) the terminal joints of the palp are narrower, the sixth segment is twice as long as wide, the seventh nearly as long as and the two distal ones rather longer than the sixth, the setae on the palp are much shorter (cf. Fig. 4 *c* and *d*); (4) the principal spines on the ovigers are thin, broadened and serrate distally, recalling those of *C. frigida* and *C. scoresbii* (cf. Fig. 7 *a*–*f* and *g*); (5) the abdomen is shorter and broader.

The specimens agree well with the types of *C. drakei*; the ocular tubercle, however, is considerably higher and more conical.

DISTRIBUTION. Previously recorded from the Ross Sea area.

Family NYMPHONIDAE

Genus **Pentanymphon**, Hodgson

Pentanymphon antarcticum, Hodgson.

Hodgson, 1904, p. 459, pl. xiv; 1907, p. 36, pl. v; 1908, p. 177.
Bouvier, 1906, p. 30, text-figs. 3–6; 1913, p. 66, text-figs. 22–24.
Calman, 1915, p. 27.
Loman, 1923, p. 9.

? St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ 00″ W, 342 m.; R. Large dredge: 1 ♂.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W, 160–335 m.; M. Large otter trawl: 1 ♂.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ 00″ S, 58° 28′ 30″ W, 391 m.; M. St. Medium otter trawl: 5 specimens.

St. 366. 6. iii. 30. 4 cables S of Cook Island, South Sandwich Islands, 77–152 m. Large otter trawl: 4 specimens.

REMARKS. Previous workers have commented on the variability of this species (Bouvier, 1913; Calman, 1915). The table of measurements opposite gives some indication of the nature and extent of this variation. Two adult males, one ovigerous the other larvigerous, were chosen at random from among the syntypes and measured. In both the neck is relatively long, the cephalic segment being 2·6–2·8 times as long as wide anteriorly; the second coxa is long (1·63–1·68[1] times the sum of the first and third) and the tarsus is rather longer than the propodus. The two Terra Nova specimens measured agree well with the syntypes; the second coxa in the male is slightly longer and in both specimens the tarsus is considerably longer than in the types.

Of the specimens in the Discovery collection, those from St. 366 agree well with the syntypes (allowing for sexual differences), but the neck is rather shorter. In the adult female from St. 195 the neck is still shorter and, unusual in adults, the tarsus is shorter than the propodus. The other specimens from the latter station are not quite mature, but in each the tarsus is rather shorter than the propodus.

The male from St. 181 has a remarkably long neck so that the cephalic segment is four times as long as wide anteriorly. Also the second coxa is unusually long and slender; the tarsus is nearly half as long again as the propodus (cf. the specimens in the Terra Nova collection).

But most interesting of all is the specimen from St. 170. Although only 2·8 mm. long it is apparently an adult male, for the genital pores are quite distinct. The neck is short, and the tarsus is not quite as long as the propodus, so that in these respects it resembles the specimens from St. 195. But the second coxa is very long, as in the specimen from St. 181. Now, as a general rule, specimens of *P. antarcticum* do not appear to reach sexual maturity until they are somewhere in the neighbourhood of 6 mm. in length. The smallest syntypes examined measured 3·4–3·8 mm. in length and were obviously immature. It is very probable that the specimen from St. 170 belongs to a much smaller species than *P. antarcticum*. But until more specimens are forthcoming, and until more is known of the changes that occur during the post-larval development of *P. antarcticum*, this question must remain undecided.

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[1] Approximately 1·4 in the ♀.

Measurements (*mm.*)

	Syntypes		Terra Nova St. 333		Discovery collection								
					St. 181	St. 366			St. 195				St. 170
	Ovig. ♂	Lar'g. ♂	♀	Ovig. ♂	♂	♀	♀	?	♀	? ♀	? ♂	?	♂
L. of proboscis ...	2·2	1·0	3·2	2·6	2·0	2·8	3·65	2·0	2·5	2·0	1·9	0·8	1·0
Diameter of proboscis	0·67	0·6	1·07	0·75	0·7	0·95	1·15	0·7	1·0	0·8	0·5	0·35	0·5
L. of trunk	6·4	6·0	7·6	7·0	7·6	7·2	8·2	5·2	6·4	6·4	5·8	3·6	2·8
L. of cephalic segment	2·8	2·6	3·6	3·0	3·6	3·0	3·8	2·3	2·5	2·4	2·4	1·4	1·2
W. across anterior cephalic lobes	1·0	1·0	1·4	1·2	0·9	1·5	1·9	1·1	1·6	1·4	1·0	0·6	0·67
W. of neck	0·4	0·39	0·6	0·5	0·33	0·6	0·8	0·4	0·6	0·5	0·4	0·23	0·27
W. across second lateral processes	3·6	3·2	4·0	3·8	3·5	3·8	4·5	3·1	3·5	3·2	2·8	1·8	1·47
L. of abdomen ...	0·6	0·6	0·8	0·8	0·6	1·0	1·3	1·2	0·8	0·6	0·45	0·4	0·5
$\frac{\text{L. of cephalic segment}}{\text{W. of cephalic lobes}}$	2·8	2·6	2·57	2·5	4·0	2·0	2·0	2·1	1·56	1·71	2·4	2·33	1·79
$\frac{\text{W. of cephalic lobes*}}{\text{W. of neck}}$	2·5	2·56	2·33	2·4	2·73	2·5	2·38	2·75	2·66	2·8	2·5	2·61	2·49
Third leg:													
First coxa	1·0	0·93	1·2	1·0	1·0	1·2	1·4	1·0	1·0	0·9	0·8	0·45	0·5
Second coxa ...	2·6	2·6	3·0	2·8	3·2	2·8	3·2	2·0	2·4	1·6	1·8	0·9	1·5
Third coxa ...	0·6	0·6	0·93	0·6	0·6	0·7	1·0	0·6	0·8	0·6	0·6	0·3	0·2
Femur	6·0	6·4	9·6	8·0	6·8	8·0	9·4	4·6	6·6	4·6	4·6	1·8	2·9
First tibia	7·2	7·2	10·2	8·8	8·2	9·2	10·0	5·6	7·4	5·0	5·4	1·7	3·2
Second tibia ...	10·0	10·4	15·2	14·0	11·7	13·6	15·0	8·6	10·4	7·4	7·8	2·85	4·8
Tarsus	1·47	1·7	2·4	2·4	2·3	2·4	2·2	1·6	1·73	1·2	1·35	0·5	0·93
Propodus	1·33	1·4	1·6	1·73	1·6	2·0	2·0	1·6	2·0	1·6	1·4	0·8	1·0
Claw	0·6	0·6	0·7	0·7	0·7	0·8	0·9	0·62	0·8	0·6	0·5	0·3	0·25
$\frac{\text{L. of coxa 2}}{\text{L. of coxae 1 + 3}}$ ...	1·68	1·63	1·41	1·75	2·0	1·47	1·33	1·25	1·33	1·07	1·29	1·2	2·14
$\frac{\text{L. of tarsus}}{\text{L. of propodus}}$ ...	1·21	1·11	1·5	1·39	1·45	1·2	1·1	1·0	0·87	0·75	0·96	0·63	0·93
$\frac{\text{L. of leg}}{\text{L. of trunk}}$	4·72	5·21	5·81	5·62	4·66	5·54	5·4	4·92	5·05	3·58	4·1	2·6	5·36

* See also Calman, 1915, p. 28.

An examination of the syntypes showed that in specimens measuring under 5 mm. in trunk length the tarsus is either shorter than, or equal to, the propodus. Thus it would appear that the tarsus is short in young specimens and, as growth proceeds, it elongates more rapidly than does the propodus. Also, in immature specimens the femur is much shorter than, and the third walking leg (claw excluded) is 2·5–4 times as long as, the trunk. In adults the femur is subequal to or longer than, and the leg is 4·6–5·8 times as long as, the trunk (see measurements). In these respects the specimen from St. 170 differs markedly from small specimens of *P. antarcticum*. This species of five-legged Pycnogonida might prove of interest to the student of heterogonic growth in Arthropoda.

Genus **Nymphon**, Fabricius, 1794

A revision of the large genus *Nymphon*, comprising some ninety species, although a long and tedious business, is much needed. In addition to the fact that many species are very imperfectly described, the characters that serve to distinguish one species from another have never been comprehensively studied. It has not been possible to devote time to a complete revision of the genus at present; the study was therefore limited to Antarctic forms.

While much work has been done on material from Antarctic and sub-Antarctic waters during the last thirty years,[1] the relationships of the species are very imperfectly known and the key to their determination given by Loman (1923, p. 14—a modification and extension of that of Bouvier, 1913, p. 72) I found to be far from satisfactory. In order to identify the Discovery material with any degree of accuracy a revision[2] of all the Antarctic species had to be undertaken.

In several instances the type specimen is immature (*N. frigidum*, Hodgson; *N. longicollum*, Hoek; *N. lanare*, Hodgson and *N. tridentatum*, Hodgson), while not a few species are known only from the female (see Table III). The species in which the adult male is known fall into two main groups, each with several atypical or aberrant forms as listed below (see also Table III). The larger[3] (group I) includes most of the species referred to the genus "*Nymphon*"[4] by those authors who recognize two genera (e.g. Hodgson, Bouvier, Loman); the smaller (group II) includes those species referred to the genus "*Chaetonymphon*" as well as several forms hitherto regarded as belonging to "*Nymphon*", viz. *N. capense*, Hodgson, *N. compactum*, Hoek, and *N. articulare*, Hodgson.

The fact that the Antarctic species fall naturally into two main groups would seem to be strong evidence in support of the validity of the genus *Chaetonymphon*, Sars. But a careful study of all the characters, many of which are represented in tabular form

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[1] E.g. Hodgson, 1907, 1908; Bouvier, 1906, 1913; Calman, 1915; Loman, 1923.

[2] The types of all the species included in Table III have been re-examined, with the exception of *N. subtile*, Loman; the Discovery specimens, however, are from the same locality as, and agree with Loman's description of, the type. (See also Gordon, 1932.)

[3] Seven of the species known only from female or immature specimens (Table III B) probably belong to group I; *N. villosum*, Hodgson belongs to group II and is allied to *N. biarticulatum* and *N. brevicaudatum*.

[4] When the word *Nymphon* is enclosed in inverted commas in the text it means *Nymphon sensu stricto* of certain authors, i.e. group I and the species listed above now placed in group II.

(Table III), shows that there is no distinctive character, or set of characters, that holds good everywhere. Indeed, exceptions abound—these will be mentioned in the discussion of each separate character—and as no practical advantage is to be gained by retaining a genus that is not definite and distinctive, I have reunited *Chaetonymphon* and *Nymphon* as Calman (1915, p. 28) and others have done.

Group I		Group II	
Typical	Atypical	Atypical	Typical
proceroides	*charcoti*	*capense*	*orcadense*
tenuipes		*compactum*	*articulare*
hiemale	*longicoxa*	*australe*	*neumayri*
gracillimum	*hamatum*		*brevicaudatum*
subtile	*brachyrhynchum*		*biarticulatum*
pfefferi	*clarencei*		*mendosum*
paucidens			*proximum*
adareanum			*bouvieri*

The main characters on which I rely for the separation of these groups are found in *the male oviger* (Table III). In the typical species of group I the fifth segment is long and slender, of approximately uniform diameter throughout, and either straight (type I, e.g. Fig. 10 *a* and *c*) or distinctly curved (type I *a*, Fig. 18 *a*). In *N. charcoti* the fifth segment is relatively short and more robust, but slightly curved and narrowed proximally (Fig. 10 *b*). The other four atypical species have the fifth segment long and slender, but distinctly expanded at the distal end though not to the same extent as is typical for group II (type I *b*, Fig. 23 *b*, cf. Fig. 27).

The majority of the species in group II have the fifth segment relatively short, usually more massive than in type I, and clubbed distally (type II, Figs. 23 *a*, 26 *a*, *c*, and 27). In the atypical species, the fifth segment is again short and rather robust, but certain parts of segments 5 and 6 or 3, 4 and 6 are thin-walled, inflated and tend to collapse when the animal is killed and fixed (type II *a*, Fig. 26 *b*, and Gordon, 1932, Figs. 10 *b* and 12 *b*).

None of the other characters is of such systematic importance as the male oviger, closely allied species often differing markedly from each other with regard to one or more of these; e.g. the chelophore of *N. paucidens*, n.sp., is very different from that of *N. pfefferi*, which not only in its oviger but in most of its other characters closely resembles it. The following survey of these characters follows the order in which they are dealt with in the specific descriptions.

Trunk. In group I, the trunk is usually slender, non-setose and loosely built, i.e. the lateral processes are separated by at least their own diameter. In *N. adareanum*, however, the lateral processes are separated by only half their own diameter.

In group II the body is usually compact and setose with the lateral processes in contact or separated by narrow intervals—up to half their own diameter. Setae are absent in three species—*N. capense*, *N. compactum* and *N. articulare*; in *N. australe* the lateral processes may be separated by their own diameter.

The neck is well defined and long, as a rule, in group I, very short in group II; but in several species of the former it is as short as in the latter group (e.g. *N. pfefferi* and *N. adareanum*).

Table III. *Antarctic species of* Nymphon.

			Specific name	Type of ♂ oviger	L. of trunk in mm.	Neck* Long	Neck* Medium	Neck* Short	L. of abdomen	No. of spinules on each finger of chela	No. of denticulate spines on oviger
A. Species of *Nymphon* of which the adult male is known	Group I ←—— "Nymphon" group ——→	I	*proceroides*	I	3–5	l.			(E.) *m.c.*^{1}	10–13	21–24
			tenuipes	I	2·5–3	l.			(E.) *d.l.*^{4}	28–42	24–34
			hiemale	I	6·8–7·2	l.			(E.) *d.l.*^{4}	27–40	36–46
			gracillimum	I	4·8–6·8	l.			(E.) *d.l.*^{4}	22–33	33–34
			gracilipes	I	3·7–5·3	l.			(E.) *d.l.*^{4}	14–22	54–59
			subtile	I *a*	2·5	l.			(E.) *d.l.*^{4} +	14–22	26–34
			pfefferi	I *a*	2–2·2			s.	(E.) *d.c.*^{1}	19–30	19–22
			paucidens	I *a*	2·5		m.→s.		(E.) *d.c.*^{1} +	7–9	17–20
			adareanum	I *a*	1·6–1·75			s.	(E.) *d.c.*^{1}	6–8	5–9
		II	*charcoti*	...	10 –18·5		m.		(E.) *d.l.*^{4} –	65–90 and 75–110	40–51
	←? Transitional forms→	III	*longicoxa*	I *b*	6·8	l.§←m.			(E.) *d.l.*^{4} +	70 and 95	38–44
			hamatum	I *b*	7·2–8·4	l.§←m.			(E.) *m.c.*^{1}	50–65	29–37
			brachyrhynchum	I *b*	4–4·2		m.←s.		(E.) *m.c.*^{1}	40–60	36–37
			clarencei	I *b*	6·4–8·2		m.←s.		(E.) *d.l.*^{4}	30–45	35–40
	Group II ←"Chaetonymphon" group→	IV	*capense*	II *a*	2·75			s.	(E.) *d.l.*^{4} +	60–65	48–50
			compactum	II *a*	6–7			s.	*d.c.*^{1} –	40–48	36–38
			australe	II *a*	4·5–5·2		m.←s.		*d.c.*^{1}	38–46	23–37
		V	*orcadense*	II	4·8–6·4			s.	*m.c.*^{1}	35–46	30–36
			articulare	II	2·5			s.	*d.c.*^{1}	18–25	24–26
			neumayri‖	II	4–4·4			s.	*m.c.*^{2}	6–9	22–27
			brevicaudatum‖	II	3·5–5			s.	*d.c.*^{1} +	29 and 35	10–17
			biarticulatum‖	II	5–5·8			s.	*m.c.*^{2}	30–33 and 40–42	12–18
			mendosum‖	II	4–5			s.	*m.c.*^{2} +	20	11–12
			proximum‖	II	5			s.	*d.c.*^{1} +	9 and 14	15
			bouvieri‖	II	3·6			s.	*m.c.*^{2}	12–16	15–18
B. Species of *Nymphon* known only from female or immature specimens			*procerum*§¶	...	7·2	l.§			(E.) *m.c.*^{1}	38 and 55	30
			distensum ¶	...	...	l.			*d.l.*^{4} +	30–33 and 60–64	42
			signatum ¶	...	...	...	...	...	*d.l.*^{4} +	35 and 62	37
			multidens	...	3·4		m.		(E.) *d.l.*^{4}	24–28	73
			*lanare***	...	7·5	l. ←m.			*d.l.*^{4} –	48 and 55	24
			*longicollum***	...	4·2	l.			(E.) *d.l.*^{4}	11 and 12	25
			*frigidum***	...	2·3	l.			*d.l.*^{4}	15–16	21
			villosum‖¶	...	4·2			s.	*d.c.*^{1} +	18 and 22	16

* The neck is regarded as short when the base of the oviger occupies the whole or two-thirds of the space between first lateral process and anterior cephalic lobe; of medium length when it occupies approximately half, and long when it only occupies one-third or less, of this space.

† Where the second is more than one-third longer than the first tibia the ratio t_2/t_1 is given in brackets.

‡ See p. 42.

§ In these three species the base of the oviger is situated midway between first lateral process and cephalic lobe.

The base of the oviger is in contact with, or only a little in front of the first lateral process as a general rule, in both groups; in three exceptional cases it is situated much farther forward, arising from the middle of the long neck—*N. longicoxa*, *N. hamatum* and *N. procerum*.

Abdomen. In group I the abdomen is elevated at an angle of 30–45° as a rule, and

Table III (*contd.*)

Palp $\frac{\text{L. of segments } 4+5}{\text{L. of segment}}$	Third leg: No. of femoral gland-openings in ♂	Third leg: $\frac{\text{L. of coxa } 2}{\text{L. of coxae } 1+3}$ in ♂ (or ♀)	Third leg: Longest tibial† segment	Third leg: $\frac{\text{L. of tarsus}}{\text{L. of propodus}}$	Third leg: $\frac{\text{L. of claw}}{\text{L. of propodus}}$	Third leg: Auxiliary claws	Third leg: Femur of ♀ $\frac{\text{L.}}{\text{max. W.}}$	Specific name		
1·3	9–12 T.	1·5–1·7	t_1	1 ±	$\frac{3}{5}$	—	5·3–5·7	*proceroides*	I	A. Species of *Nymphon* of which the adult male is known
1	6–7	2	t_2	1 +	1 ±	—	8	*tenuipes*		
1 +	12–16‡	1·8–1·95	t_2 (1·5)	1 —	$\frac{1}{2}$ —	+	8·5–9·5	*hiemale*		
0·75–0·85	10 T.‡	2 —	t_2 (1·4)	$1\frac{1}{3}$–$1\frac{1}{4}$	$\frac{1}{2}$	+		*gracillimum*		
1·3	13–16	1·5	t_2 (1·5)	1 +	$\frac{1}{3}$ —	+	10–12	*gracilipes*		
1	8–9	1·5–1·75	t_2	$\frac{3}{5}$	$\frac{1}{3}$	+	6·5	*subtile*		
1 —	4 T.	1 +	t_2	$\frac{1}{3}$	$\frac{1}{3}$	+	4–5	*pfefferi*		
1	4 T.	1 +	t_2	$\frac{1}{2}$	$\frac{1}{3}$	+	5·3	*paucidens*		
0·6 –0·7	2–3 T.	1 +	t_2	$\frac{1}{4}$	$\frac{1}{2}$ ±	+	3·5	*adareanum*		
2 +	20	1 +	t_2	1 ±	1 ±	—	11–12	*charcoti*	II	
0·65–0·7	? 8	2 +	t_2 (1·6)	$\frac{3}{4}$	$\frac{3}{5}$	—	10	*longicoxa*	III	
0·7–0·8	12–13 T.	1·4	t_1	1 + –$\frac{2}{3}$	$\frac{1}{2}$ —	—	10	*hamatum*		
2·5	? 30	2	t_2	$\frac{2}{3}$	$\frac{1}{2}$	+	5·4	*brachyrhynchum*		
1·3	10–12	2–1·75	t_2 (1·4)	$\frac{2}{3}$	$\frac{1}{2}$	+	5	*clarencei*		
1 +	?	1·2	t_2	$\frac{4}{5}$	$\frac{3}{4}$	—	4·7	*capense*	IV	
1·2–1	20–27	1 +	t_1	2	$\frac{1}{2}$ +	—	4·7	*compactum*		
1 ±	16–18	1 +	t_1	$1\frac{1}{2}$–$1\frac{1}{4}$	$\frac{1}{2}$ —	v.	3·5–4·5	*australe*		
1 ±	30	1 +	t_2	$1\frac{1}{3}$–1	$\frac{1}{2}$ —	+	3·8	*orcadense*	V	
0·78	?	1	t_1	1 —	$\frac{1}{2}$ —	+	3	*articulare*		
0·75	?	1	t_1	1 ±	$\frac{1}{2}$	+	2·5	*neumayri* ‖		
0·4–0·54	3–4 T.	1	t_1	$\frac{4}{5}$	$\frac{1}{3}$ +	+	2·3	*brevicaudatum* ‖		
0·4–0·5	5–6 T.	1	t_1	$1\frac{1}{4}$ – 1	$\frac{1}{3}$ ±	+	2·4	*biarticulatum* ‖		
0·35–0·44	4–5 T.	1	t_1	$\frac{4}{5}$ +	$\frac{1}{3}$ ±	+	3·2	*mendosum* ‖		
0·42	5–7 T.	1	t_1	$\frac{4}{5}$	$\frac{1}{3}$ —	+		*proximum* ‖		
0·26–0·28	3–4 T.	1	t_1	$\frac{2}{3}$	$\frac{1}{2}$ —	+	2·2	*bouvieri* ‖		
1 +	...	1 +	t_2	$\frac{1}{2}$ +	$\frac{1}{3}$ —	—	8·4	*procerum* §¶		B. Species of *Nymphon* known only from female or immature specimens
0·78	...	...	t_2 (1·46)	$\frac{3}{4}$	$\frac{1}{2}$ —	+	...	*distensum* ¶		
0·96	...	...	t_2	...	...	+	...	*signatum* ¶		
0·88	...	1·5	t_2 (1·5)	$\frac{1}{2}$	$\frac{1}{4}$ —	+	6·6	*multidens*		
2	...	1 +	t_2	1 +	$\frac{9}{10}$	—	...	*lanare* **		
0·83	...	2·86	t_2	1	$\frac{1}{2}$ —	—	...	*longicollum* **		
1	...	1	t_2	$\frac{1}{2}$	$\frac{1}{2}$ —	+	...	*frigidum* **		
0·66	...	...	t_1	$\frac{4}{5}$	$\frac{1}{3}$ +	+	3	*villosum* ‖¶		

‖ Species with the last two body segments fused.
¶ Species known only from adult female.
** Species known only from immature specimens.
Explanation of lettering used:—*d.* = to distal end of; *m.* = to middle of; $l.^4$ = fourth lateral process; $c.^1$ and $c.^2$ first and second coxae respectively; t_1 and t_2 first and second tibia respectively; T. raised femoral gland tubercles present; v. vestigial; (E.) elevated.

rarely extends beyond the middle of the first coxa. In group II it is not elevated above 10° except in *N. capense* (45°), and generally extends at least to the distal end of the first coxa (see Table III for exceptions).

Chelophore. In group II the scape often bears a number of long, rather stout setae;

in several species, however, these setae are short and few in number, e.g. *N. articulare*, *N. capense*, *N. compactum.* In group I, the setae, as a rule, are either few and fine or wanting; in a few exceptional cases (e.g. *N. adareanum*, Gordon, 1932, p. 99, fig. 1 *a*) a few strong setae are present.

With regard to the chela there is so much variation in each group that no generalization[1] can be made. The palm may be shorter than wide (*N. proceroides* and *N. neumayri*, n.sp. (Figs. 9 and 29 *d*), or as much as 3–4 times as long as wide (*N. biarticulatum*, *N. longicoxa*, *N. procerum*, Fig. 32 *a* and Gordon, 1932, figs. 7 and 9 *a*). The number of spinules on each finger of the chela is very variable (6–110, see Table III); in a few instances there are many more spinules on one finger than on the other, e.g. *N. longicoxa* (70 and 90–110).

Palp. Segments 2–5 are long and subequal in a few exceptional cases (*N. charcoti*, *Nymphon*, sp.? (St. 181), *N. lanare* and *N. brachyrhynchum*—the last is not closely related to the other species). In all other forms, segments 2–5 are of different lengths and segment 2 is usually longest although the third may not be much shorter. As a general rule the ratio $\frac{\text{length of segments } 4+5}{\text{length of segment } 2}$ lies between 0·75 and 1·3; in five species of group II it is less than 0·6 (usually less than 0·5, see Table III).

Number of spines on oviger. With one exception (*N. adareanum*, Hodgson, 1907, pl. iii, fig. 3 *b*) each of the four terminal segments of the oviger bears a number of denticulate spines. Loman (1923, p. 11) has shown that the total number of these spines remains within certain definite limits for each species. This total may be less than ten or as high as seventy in exceptional cases (see Table III); also it may be the same in several unrelated species, e.g. 30–38 in *N. tenuipes*, *N. hamatum* and *N. brachyrhynchum* of group I and *N. australe*, *N. compactum* and *N. orcadense* of group II.

Third leg. In all the species of group II and most of those of group I *a* (in which segment 5 of the male oviger is long, slender and distinctly curved) and in *N. charcoti* the second coxa is approximately equal in length[2] to the sum of the first and third. In all the other species of group I the second coxa, especially in the male, is much longer. The femoral gland openings in the male vary greatly in number; in several instances they have not been detected. In the female, the femur is at least five times as long as wide in all species of group I, *N. pfefferi* and *N. adareanum* excepted. In group II it is usually less than four times as long as wide, but is nearly five times in each of the atypical forms.

The second is longer than the first tibia, as a rule, in group I, and the reverse holds for most of the species in group II (Table III).

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[1] Loman (1923, p. 10) says that in "*Nymphon*" the "hand" is not conspicuously broadened distally, whereas in "*Chaetonymphon*" it is much broadened distally, but I am afraid I do not quite understand this distinction. The palm in Figs. 32 and 29 *d* is not much broadened distally, yet these species are typical "*Chaetonymphons*". The only Antarctic species in which the palm is broadened distally is *N. multidens*, n.sp. (Fig. 35 *d*).

[2] The dorsal measurements are always given for the segments of the leg so that the third coxa is much shorter than if measured ventrally.

The auxiliary claws are usually well developed, but may be absent or, as in one case, vestigial. The presence or absence of these claws has been used as the first division in Key II, which is not concerned with possible relationships between the species, because this character is (1) convenient and (2) is, so far as our knowledge goes, constant for each species at all stages from immature to adult, and in both sexes.

The third leg is 5–7 times as long as the trunk, and either smooth or slightly setose in group I. In group II it is 3–4·5 times as long as the trunk in all forms except *N. capense* and *N. compactum* (6); while the legs are usually very setose, the two species just mentioned and *N. articulare* are again exceptions.

Synonymy. With regard to synonymy, *N. gracillimum*, Calman, may prove to be the same as *N. hiemale*, Hodgson; *N. charcoti*, Bouvier, with *N. lanare*, Hodgson, and *N. biarticulatum*, Hodgson, with *N. brevicaudatum*, Miers.

SYNOPTIC KEY TO THE DETERMINATION OF THE ADULT MALES OF ANTARCTIC AND SUB-ANTARCTIC SPECIES OF *NYMPHON*[1]

I. Segment 5 of ♂ oviger long and narrow, straight or distinctly curved, of approximately uniform diameter throughout.

  A. Auxiliary claws absent [tarsus and propodus both elongated, subequal, without spines on ventral margin; second coxa long, segment 5 of ♂ oviger straight (type I)].

    1. Less than 20 (10–13) spinules on each finger of chela; 21–24 denticulate spines on oviger; 9–12 low femoral gland-tubercles; first tibia the longest segment; claw three-fifths of propodus..........*N. proceroides*, Bouvier

    2. More than 20 (28–42) spinules on each finger of chela; 24–34 denticulate spines on oviger; 6–7 femoral gland-openings, but no raised tubercles; second tibia the longest segment; claw subequal to propodus..........*N. tenuipes*, Bouvier

  B. Auxiliary claws well developed [second tibia the longest segment].

    1. Segment 5 of ♂ oviger straight (type I).

      a. Number of denticulate spines less than 50 (30–46).

        i. Two terminal palpal segments together equal to or slightly longer than second segment; tarsus rather shorter than propodus; 12–16 femoral gland-openings—low tubercles occasionally present..........*N. hiemale*, Hodgson

        ii. Two terminal palpal segments together rather shorter than second segment; tarsus considerably longer than propodus; 10 low femoral gland tubercles *N. gracillimum*, Calman

      b. Number of denticulate spines exceeding 50 [14–22 spinules on each finger of chela; 13–16 small femoral gland-openings]..........*N. gracilipes*, Miers

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[1] Use in conjunction with Table III, p. 28; the large Roman numerals in the left-hand column of table represent the five primary subdivisions of the key. Slight discrepancies in the numbers of spines on the fingers of the chela or of the oviger may occur, but are not important—e.g. in Table III the number of spines of each finger of the chela of a single specimen of *N. longicoxa* is given, while in the key the lowest and the highest number of spines on the movable finger of several adults is given. In Table III the ratios represented by fractions are only approximate; where decimals are employed a higher degree of accuracy has been aimed at.

2. Segment 5 of ♂ oviger distinctly curved (type I *a*).

a. More than 10 spinules on each finger of chela (20–30 in adults).

i. 26–34 denticulate spines on oviger; second coxa at least half as long again as the sum of the first and third; 8–9 femoral gland-openings, but no raised tubercles; tarsus at least half as long as propodus ....*N. subtile*, Loman

ii. 19–22 denticulate spines on oviger; second coxa scarcely longer than the sum of the first and third; 4 wide femoral gland-tubercles; tarsus only one-third of propodus..*N. pfefferi*, Loman

b. Less than 10 (6–9) spinules on each finger of chela [2–4 low, wide femoral gland-tubercles].

i. Number of denticulate spines on oviger 17–20; tarsus half of propodus; ventral margin of the latter setose..................................*N. paucidens*, n.sp.

ii. Number of spines on oviger 5–9, *not denticulate*; tarsus one-fourth of propodus; ventral margin of the latter spinose ....*N. adareanum*, Hodgson

II. Segment 5 of ♂ oviger relatively short—less than twice as long as segment 6—and stout, narrowed and slightly curved in proximal third (Fig. 10 *b*) [palpal segments 2–5 subequal, long; auxiliary claws absent; second tibia the longest segment; 20 femoral gland-openings; 40–50 denticulate spines on oviger; 75–110 spinules on movable finger of chela (10–20 less on immovable one); tarsus, propodus and claws subequal] ...*N. charcoti*, Bouvier

III. Segment 5 of ♂ oviger long and slender; expanded somewhat at distal end (type I *b*) [total number of denticulate spines on oviger 30–44].

A. Neck relatively long with oviger base inserted midway between first lateral process and anterior cephalic lobe; auxiliary claws absent [chela long and sickle shaped; two terminal palpal segments together $\frac{2}{3}$–$\frac{3}{4}$ of second segment].

1. Second coxa more than twice the sum of the first and third; second tibia the longest segment; 90–110 spinules on movable finger of chela; eyes present *N. longicoxa*, Hoek

2. Second coxa less than twice the sum of the first and third (1·4 : 1); first tibia the longest segment; 60–65 spinules on movable finger of chela; eyes absent [spur on distal end of femur; 12–13 femoral gland-tubercles].....................*N. hamatum*, Hoek

B. Neck relatively short, oviger base in contact with first lateral process; auxiliary claws present [second tibia the longest segment; second coxa long].

1. Palpal segments 3 and 4 subequal and longer than 2 and 5 which are again subequal; fingers of chela curved inwards towards scape distally, each armed with 40–60 spinules; 30 femoral gland-openings ....*N. brachyrhynchum*, Hoek

2. Palpal segments 4 and 5 together rather longer than second segment, 2 and 3 subequal; fingers of chela not curved distally, each armed with 30–45 spinules; 10–12 femoral gland-openings ....*N. clarencei*, n.sp.

IV. Segment 5 of ♂ oviger relatively short, portions of segments 5 and 6 or 3, 4 and 6 thin-walled, inflated, often partially collapsed in fixed material (type II *a*); neck short, body rather compact; auxiliary claws absent or vestigial.

A. Second tibia the longest segment; 60–65 spinules on each finger of chela; 48–50 denticulate spines on oviger; tarsus shorter than propodus (4 : 5) [portions of segments 3, 4 and 6 of ♂ oviger thin-walled, segment 6 setose on the thin-walled area, segment 5 short, slightly curved and widening gradually towards the distal end] *N. capense*, Hodgson

B. First tibia the longest segment; 38–48 spinules on each finger of chela; 23–38 denticulate spines on oviger; tarsus longer than propodus.

1. Auxiliary claws absent; tarsus twice as long as propodus; segment 5 of ♂ oviger short, considerably expanded in distal half; 20–27 femoral gland-openings *N. compactum*, Hoek

2. Auxiliary claws vestigial; tarsus not more than half as long again as propodus; segment 5 of ♂ oviger greatly inflated in distal half (thin-walled part usually collapsed); 16–18 femoral gland-openings ....*N. australe*, Hodgson

V. Segment 5 of ♂ oviger relatively short and distinctly clubbed at distal end (type II); neck short and body compact; auxiliary claws well developed.

A. Two terminal palpal segments together at least three-fourths of second segment; no femoral gland-tubercles; number of denticulate spines on oviger exceeding 20 (22–36) in adults.

1. Second tibia the longest segment; 30–36 denticulate spines on oviger; 35–46 spinules on each finger of chela; two terminal palpal segments together subequal to second segment; 30 femoral gland-openings ....*N. orcadense*, Hodgson

2. First tibia the longest segment; 22–27 denticulate spines on oviger; less than 30 spinules on each finger of chela; two terminal palpal segments together three-fourths of second segment; femoral gland-openings not observed.

a. 18–25 short curved spinules on each finger of chela; palm approximately twice as long as high ....*N. articulare*, Hodgson

b. 6–9 long spinules on each finger of chela; palm only as long as high [trunk segments 3 and 4 fused] ....*N. neumayri*, n.sp.

B. Two terminal palpal segments together approximately one-half to one-fourth of second segment; 3–7 wide femoral gland-tubercles; number of denticulate spines on oviger less than 20 (10–18) [first tibia the longest segment; trunk segments 3 and 4 fused].

1. Number of spinules on each finger of chela exceeding 25 (28–45).

a. Ocular tubercle of medium height; fingers of chela rather shorter than palm; tarsus in adults considerably shorter than propodus (much shorter in immature specimens) ....*N. brevicaudatum*, Miers

b. Ocular tubercle high; fingers of chela equal to or rather longer than palm; tarsus in adults rather longer than, in immature specimens subequal to, propodus ....*N. biarticulatum*, Hodgson

2. Number of spinules on each finger of chela less than 25 (9–20).

a. Fingers longer than palm [each armed with approximately 20 spinules; 2–3 short, spinose projections on each lateral process and each first coxa; tarsus and propodus spinose] ....*N. mendosum*, Hodgson

b. Fingers shorter than palm.

i. Ocular tubercle only as high as wide; two terminal palpal segments together two-fifths of second segment; setae on legs much shorter than the diameter of the segments carrying them ....*N. proximum*, Calman

ii. Ocular tubercle long and slender, 4–6 times as high as wide; two terminal segments very short, together only one-fourth of second segment; long setae on scape, lateral processes and legs, equal to or longer than the diameter of the segments carrying them...*N. bouvieri*, n.sp.

ARTIFICIAL KEY TO THE DETERMINATION OF ANTARCTIC AND SUB-ANTARCTIC SPECIES OF *NYMPHON*

1. Auxiliary claws absent or vestigial 2

Auxiliary claws well developed 12

2. Four terminal palpal segments long, subequal 3

Four terminal palpal segments of different size; two terminal segments together from $\frac{2}{3}$–$1\frac{1}{3}$ of second segment 4

3. 40–51 denticulate spines in adults; 90–110 spinules on movable finger of chela; legs smooth; ♂ oviger as in Fig. 10 *b*........................*N. charcoti*, Bouvier

30–31 denticulate spines in adults; 70–85 spinules on fingers of chela; legs setose, setae very fine ....*N. charcoti* var. (? = *lanare*, Hodgson)

4. Oviger base arises from middle of neck 5

Oviger base in contact with first lateral process 7

5. Eyes well developed [second tibia the longer segment; 90–100 spinules on movable finger of chela which has the tip recurved]........................*N. longicoxa*, Hoek

Eyes absent; ocular tubercle obsolete 6

6. Spur on distal end of femur; first tibia rather longer than second; 50–65 spinules on each finger of chela; tarsus and propodus subequal ....*N. hamatum*, Hoek

No spur on distal end of femur; second tibia the longer segment; 38 and 55 spinules on each finger of chela; tarsus just over one-half of propodus ....*N. procerum*, Hoek

7. Neck long, lateral processes separated by their own diameter or more........................8

Neck short, lateral processes separated by half their own diameter, or less, as a rule 10

8. Spinules on each finger of chela less than 20 (10–13) 9

Spinules on each finger of chela more than 20 (28–42) [palm long and narrow; ♂ oviger of type I second tibia the longest segment; 3–4 long setae at distal end of femur] *N. tenuipes*, Bouvier

9. Eyes well developed palm very short; ♂ oviger of type I; first tibia the longer segment; second coxa half as long again as the sum of the other two ....*N. proceroides*, Bouvier

Eyes absent, though ocular tubercle present; second tibia the longest segment; second coxa nearly three times the sum of the other two ....*N. longicollum*, Hoek

10. First tibia the longer segment; tarsus longer than propodus; 38–48 spinules on each finger of chela; 23–38 denticulate spines on oviger 11

Second tibia the longer segment; tarsus four-fifths of propodus; 60–65 spinules on each finger of chela; 48–50 denticulate spines on oviger........................*N. capense*, Hodgson

11. Eyes and ocular tubercle absent; tarsus twice as long as propodus ....*N. compactum*, Hoek

Eyes present, ocular tubercle high; tarsus half as long again as propodus or rather less *N. australe*, Hodgson

12. Spines on four terminal segments of oviger not denticulate and numbering less than 10 (5–9) [♂ oviger of type I *a*; 6–9 spinules on each finger of chela; tarsus one-fourth of propodus, the latter spinose on ventral margin; neck short] ...*N. adareanum*, Hodgson

Spines on four terminal segments of oviger denticulate 13

13. Four terminal segments of palp each long, third and fourth subequal and longer than second and fifth which are again subequal [♂ oviger of type I *b*; 40–60 spinules on each finger of chela, fingers slender and bent distally] ....*N. brachyrhynchum*, Hoek

Four terminal segments of palp of different size; two terminal segments together vary from equality with, to one-fourth of, second segment........................14

14. Second tibia the longer segment 15
First tibia the longer segment [♂ oviger of type II] 21

15. Total number of denticulate spines on oviger at least 70; chela with immovable finger very short, only half of palm, 24–28 crowded spinules on each finger; tarsus half of propodus. *N. multidens*, n.sp.
Total number of denticulate spines on oviger 54–59; 14–22 spinules on each finger of chela; tarsus and propodus subequal [♂ oviger of type I] ....*N. gracilipes*, Miers
Total number of denticulate spines on oviger 46–30 16
Total number of denticulate spines on oviger less than 25 20

16. Approximately twice as many spinules on movable as on immovable finger of chela
N. distensum, Möbius[1]
N. signatum, Möbius
An almost equal number of spinules on each finger of chela or difference not exceeding 25 per cent. 17

17. Second coxa half as long again the sum of the first and third or longer 18
Second coxa short, subequal to the sum of the other two [neck short; ♂ oviger of type II and segment 7 termino-laterally articulated on segment 6; 40–46 spinules on each finger of chela; at least 30 femoral gland-openings in ♂] ....*N. orcadense*, Hodgson

18. Tarsus and propodus subequal ($\frac{4}{5}$–$\frac{5}{4}$); 27–40 spinules on each finger of chela; ♂ oviger of type I; 10–16 femoral gland-openings in ♂ ....*N. hiemale*, Hodgson
(? = *N. gracillimum*, Calman)
Tarsus $\frac{1}{2}$–$\frac{2}{3}$ of propodus 19

19. Neck long; 14–24 spinules on each finger of chela; oviger of type I *a* and 4 femoral gland-tubercles in ♂ ....*N. subtile*, Loman
Neck short to medium; 30–45 spinules on each finger of chela; oviger of type I *b* and 10–12 femoral gland-openings in ♂ ....*N. clarenci*, n.sp.

20. Less than 10 spinules on each finger of chela; tarsus half of propodus; oviger of type I *a* and 4 femoral gland-tubercles in ♂ ....*N. paucidens*, n.sp.
[15–16 spinules on each finger of chela; neck long; tarsus half of propodus, the latter spinose on ventral margin (type immature) ....*N. frigidum*, Hodgson]
19–30 spinules on each finger of chela; tarsus one-third of propodus; neck short; oviger of type I *a* and 4 femoral gland-tubercles in ♂ ....*N. pfefferi*, Loman
(= *N. antarcticum*, Pfeffer)

21. Number of denticulate spines on oviger exceeding 20 [two terminal palpal segments together three-fourths of second segment; femur much enlarged in ♀] 22
Number of denticulate spines on oviger less than 20 [and trunk segments 3 and 4 fused] ...23

22. 6–9 long spinules on each finger of chela, fingers curved, gaping; palm only as long as high [trunk segments 3 and 4 fused] ....*N. neumayri*, n.sp.
18–25 short, curved spinules on each finger of chela; palm approximately twice as long as high ....*N. articulare*, Hodgson

23. Two terminal palpal segments together two-thirds of second segment; 18–22 spinules on each finger of chela........*N. villosum*, Hodgson
Two terminal palpal segments together one-half of second segment or rather less 24
Two terminal palpal segments together one-fourth of second segment; ocular tubercle very slender and 4–6 times as high as wide ....*N. bouvieri*, n.sp.

24. Number of spinules on each finger of chela exceeding 30; ocular tubercle higher than wide ...25
Number of spinules on each finger of chela less than 20; ocular tubercle low and wide 26

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[1] These two species appear to differ somewhat, but each is imperfectly known.

25. Ocular tubercle of medium height; fingers rather shorter than palm; tarsus somewhat shorter than propodus in adults, much shorter in young specimens *N. brevicaudatum*, Miers

Ocular tubercle high; fingers equal to or rather longer than palm; tarsus scarcely shorter than propodus in young, rather longer than the latter in adults *N. biarticulatum*, Hodgson

26. Fingers longer than palm, spinules long and numbering about 20; 2 or 3 short spinose projections on each lateral process and each first coxa ....*N. mendosum*, Hodgson

Fingers shorter than palm, spinules short, numbering 9 on immovable, 14 on movable finger; no spinose projections on lateral processes or first coxae......*N. proximum*, Calman

A. GROUP I

Nymphon proceroides, Bouvier (Figs. 9, 10 *a* and 75).

Bouvier, 1913, pp. 90–94, text-figs. 42–50.
Loman, 1923, p. 14 (in key).

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W, 160–335 m.; M. Large otter trawl: a dozen specimens with *N. tenuipes* and *Nymphon* sp.?

St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 21′ S, 62° 58′ W, 278–500 m.; M. Large otter trawl: 2 ♀♀, 4 ♂♂ and 2 immature specimens.

St. 186. 16. iii. 27. Fournier Bay, Anvers Island, Palmer Archipelago, 64° 25′ 30″ S, 63° 02′ W, 295 m.; M. Large dredge: 3 ♂♂.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W, 259 m.; M. Large dredge: a dozen specimens.

DESCRIPTION OF MALE. *Trunk* of loose build, lateral processes widely separated—up to twice their own diameter. Neck long, base of oviger in contact with first lateral process. Ocular tubercle low, wide, rounded; eyes well developed.

Proboscis short, robust, sub-cylindrical, much shorter than cephalon.

Abdomen reaching to middle of first coxa, elevated at an angle of about 20°.

Chelophore. Scape rather longer than proboscis, length 3·5–4 times the distal width. Palm very short and high; fingers twice as long as palm, each armed with 10–13 curved spinules as represented in Fig. 9; setose pad extending nearly half-way along immovable finger.

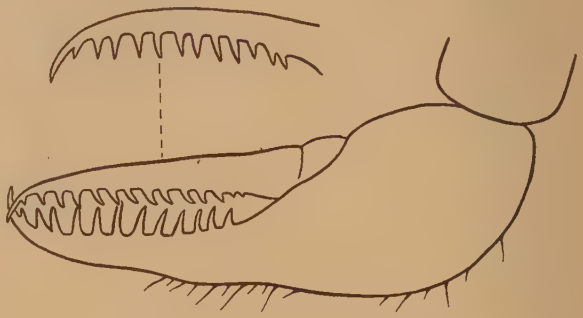

Fig. 9. *Nymphon proceroides*, Bouvier. Chela: × 60.

Palp. Third a little longer than, two terminal segments together longer than, second segment (1·25–1·33 : 1); segments 2–5 in the proportions 3·25 : 3·5 : 2·5 : 1·65.

Oviger (type I). Terminal claw approximately two-thirds of tenth segment, armed with 4–7 spinules. Total number of denticulate spines 21–24. Segments 4–6 in the proportions 2·14 : 2·86 : 1 (♀ 1·5 : 2 : 1); fifth segment nearly straight, long, and of almost uniform diameter throughout (Fig. 10 *a*).

Third leg. Second coxa long and slender, half as long again as the sum of the other two (1·5–1·7 : 1). Femur slightly shorter than second tibia; a row of 9–12 prominent gland papillae on proximal, mid-ventral surface. First tibia the longest segment, half as long again as femur. Tarsus and propodus both elongated, subequal; claw long, about three-fifths of propodus; auxiliaries absent.

Measurements (*mm*.)

	♀
Length of proboscis	1·2
Diameter of proboscis	0·67
Length of trunk	5·0
Length of cephalic segment	2·13
Width of anterior cephalic lobes ...	1·07
Width of neck	0·4
Width across second lateral processes	2·6
Length of abdomen	0·93

Third leg:	♀	♂
First coxa	0·8	0·7
Second coxa	2·0	1·7
Third coxa	0·8	0·53
Femur	3·6	3·4
First tibia	5·47	4·6
Second tibia	4·0	3·7
Tarsus	1·55	1·47
Propodus	1·65	1·47
Claw	1·0	0·93

REMARKS. Bouvier has given a long and careful description of this species; Fig. 75 represents an abnormal palp of a co-type in the Paris Museum collection. The Discovery specimens agree very closely with the types.

This species is most closely allied to *N. tenuipes*, Bouvier (p. 39), but can readily be distinguished from the latter by (1) the chela with its shorter palm and fewer spinules on the fingers, and (2) the absence of very long setae on the walking legs.

DISTRIBUTION. Previously recorded from the South Shetlands.

Nymphon tenuipes, Bouvier (Figs. 10*c* and 11).

Bouvier, 1913, pp. 86–90, text-figs. 35–41.
Loman, 1923, p. 14 (in key).

St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 63° 17′ 30″ S, 61° 17′ W, 1080 m.; M. cs. St. Large dredge: 1 ♂.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W, 160–335 m.; M. Large otter trawl: 1 ♀ and 5 immature specimens.

DESCRIPTION OF MATURE MALE. *Trunk* slender and loosely built; lateral processes separated by one and a half, to more than twice, their own diameter. Neck long, base of oviger in contact with first lateral process. Ocular tubercle low, broad, rounded at apex; eyes well developed.

Proboscis sub-cylindrical, three-fourths of scape and of cephalon.

Abdomen short, reaching to distal end of fourth lateral process, elevated at an angle of about 40–45°.

Chelophore slender. Scape with a few fine setae; length six times the distal width. Chela subequal to scape, palm long and narrow, setose pad very short; fingers armed with about 39 and 42 spinules respectively (Fig. 11 *b*).

Palp slender. Segments 2–5 in the proportions 10 : 6·5 : 5 : 5.

Oviger long and slender. Terminal claw a little shorter than tenth segment, armed with ten long spinules. Total number of denticulate spines 34 (10 + 9 + 7 + 8). Segments 4–6 in the proportions 2 : 3·43 : 1; fifth segment long, slender, nearly straight, and of almost uniform diameter throughout (Fig. 10 *c*).

Third leg long and slender. Second coxa twice the sum of the other two. Femur shorter than either tibia; three very long, slender setae dorsally at distal articulation; no distinct raised gland tubercles on mid-ventral surface but six or seven obscure gland openings present. Both tibias bearing long slender setae (Bouvier, 1913, fig. 41), second the longest segment. Tarsus, propodus and claw elongated; claw shorter than propodus in this specimen (but equal to or even slightly longer than propodus in the other specimens). Auxiliaries absent.

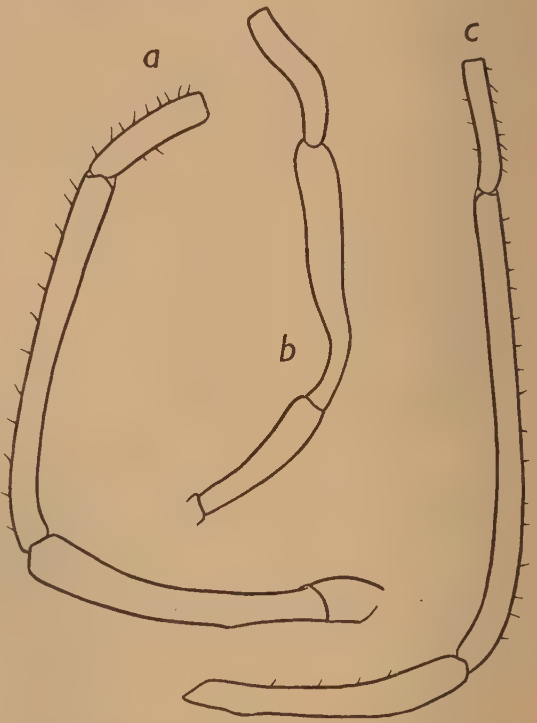

Fig. 10. Segments 4–6 of male oviger of: *a. Nymphon proceroides*, Bouvier: × 27. *b. N. charcoti*, Bouvier: × 7. *c. N. tenuipes*, Bouvier: × 27.

FEMALE. One specimen from St. 181 is undoubtedly a female of this species, but it differs from the normal female in one interesting respect. The two posterior pairs of walking legs are quite typical; each second coxa is enlarged distally and has a large genital pore; the femur is considerably widened proximally and contains developing ova (Fig. 11 *a*).

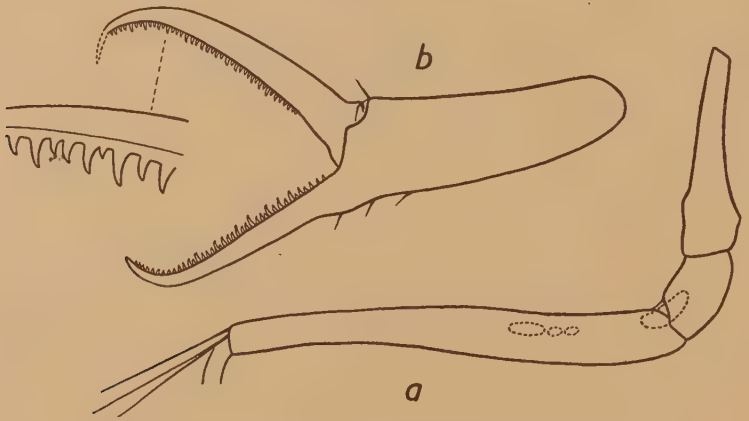

Fig. 11. *Nymphon tenuipes*, Bouvier. *a*. Femur and two distal coxae of third leg of female: × 20. *b*. Chela × 60.

The two anterior pairs of legs, however, are short,[1] slender like those of immature specimens, and have no genital pores.

The oviger is of the usual female type; the fifth is scarcely longer than the fourth, and twice as long as the sixth segment. The total number of denticulate spines is 32 (9 + 8 + 7 + 8).

Measurements (*mm.*)

	St. 177 ♂	St. 181 ♀	
Length of proboscis	0·9	1·0	
Diameter of proboscis	0·37	0·47	
Length of trunk	2·8	2·95	
Length of cephalic segment	1·23	1·35	
Width of anterior cephalic lobes	0·5	0·55	
Width of neck	0·25	0·3	
Width across second lateral processes	1·33	1·2	
Length of abdomen	0·35	0·5	
Leg:	(3rd)	(4th)	(1st)
First coxa	0·4	0·4	0·4
Second coxa	1·4	1·6	1·1
Third coxa	0·3	0·35	0·3
Femur	3·33	3·4	2·13
First tibia	4·7	4·93	2·67
Second tibia	5·0	5·47	2·8
Tarsus	1·5	1·6	0·73
Propodus	1·33	1·33	0·73
Claw	1·0	1·25	0·59

REMARKS. This is a very small species; Bouvier states that the holotype is immature, but it is in reality an almost, if not quite, mature male. There are 32–33 denticulate spines on the oviger and about twelve spinules on the terminal claw, although the latter have been omitted in Fig. 38 (Bouvier, 1913, p. 88). The spinules on the fingers of the chela number approximately 24 and 30–35 respectively.

N. tenuipes is most nearly related to *N. proceroides*, Bouvier, with which it was taken at one station, but the chelophore is more slender, and the chela especially is very different (cf. Figs. 9 and 11 *b*); the long setae on the femur are very characteristic.

DISTRIBUTION. Previously recorded from the South Shetland Islands.

Nymphon hiemale, Hodgson (Figs. 12 *a* and 13 *c*).

Nymphon hiemale, Hodgson, 1907, p. 20, pl. iii, fig. 1; pl. x, fig. 8.
Nymphon hiemale, Bouvier, 1913, p. 73 (in key).
Nymphon hiemale, Calman, 1915, p. 32.
Nymphon hiemale, Loman, 1923, pp. 14 and 16.
? *Nymphon gracillimum*, Calman, 1915, p. 30, Fig. 5 A–D.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 3·3 miles S 45° E of Jason Light, 110 m.; M. R. Large dredge: 4 specimens, including 1 ovigerous ♂.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock, 179–235 m.; gy. M. Large otter trawl: 2 specimens, 1 overgrown by a large compound Tunicate.

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[1] Compare the measurements of the fourth and the first leg; the third is incomplete.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m.; M. Large otter trawl: 3 specimens.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point, to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 4 specimens, including 1 ovigerous ♂.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 5 specimens including 1 ovigerous ♂.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W, 155–178 m.; gn. M. S. Large otter trawl: 1 specimen.

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock, 200–234 m.; M. Large otter trawl: 5 adult (including 2 ovigerous and 1 larvigerous ♂♂) and 1 immature specimens.

St. 159. 21. i. 27. 53° 52′ 30″ S, 36° 08′ W, 160 m.; R. Large dredge: 2 specimens.

St. 160. 7. ii. 27. Near Shag Rocks, 53° 43′ 40″ S, 40° 57′ W, 177 m.; gy. M. St. R. Large dredge: 3 ♂♂ (1 ovigerous and 1 larvigerous). On the label there is the following note: "Body testaceous. Proboscis with red flecks dorsally. Ill-defined red patches as follows: at either end of basal segment of chelophore: on leg processes of body: on 1st and 3rd leg segments, on 2nd and 4th at proximal end and on 2nd, 4th and 5th in distal third. All legs similarly coloured".

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 1 very small but ovigerous ♂.

REDESCRIPTION OF HOLOTYPE.[1] *Trunk* with lateral processes separated by approximately their own diameter. Neck long, the oviger base occupying one-third thereof and in contact with first lateral process. Ocular tubercle as high as wide, rounded; eyes well developed.

Proboscis equal to cephalic segment (cf. Calman, 1915, p. 32), subequal to scape, somewhat expanded in middle and again at apex.

Abdomen short, reaching to distal end of fourth lateral process; elevated at an angle of about 25°.

Chelophore. Scape rather longer than chela, length about five times the maximum width. Fingers somewhat longer than palm; approximately thirty-five spinules on movable, twenty-seven on immovable one; setose pad extending nearly one-third along the latter.

Palp with segments 2–5 in the proportions 8 : 7 : 4 : 5.

Oviger. Terminal claw rather more than half of tenth segment, armed with 10–12 spinules; total number of denticulate spines, forty-one.

Third leg. Second coxa two-thirds as long again as the sum of the other two (1·65 : 1, measured dorsally). Femur a little shorter than, second half as long again as, first tibia. Tarsus subequal to propodus (8 : 9), ventral margin of the latter spinose (Fig. 12 *a*). Claw not quite half as long as propodus, auxiliaries well developed.

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[1] Female, selected by Calman, 1915, p. 32, in B.M. collection.

Male paratypes, measuring 6·8 and 7·1 mm.[1] in length (trunk only), agree in most respects with the holotype. There are forty-two and forty-three denticulate spines respectively on the four terminal segments of the oviger. The second coxa is longer (1·85 and 1·95 : 1).

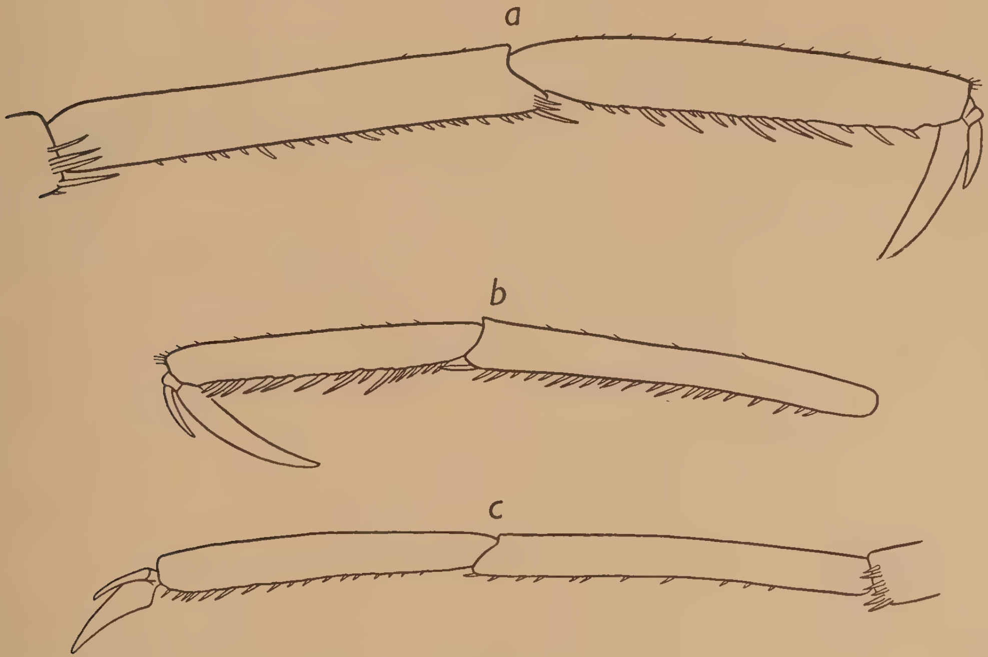

Fig. 12. Terminal segments of third leg of: *a. Nymphon hiemale*, Hodgson, paratype. *b. N. gracillimum*, Calman, holotype. *c. N. gracilipes*, Miers, holotype.

Table IV

	N. hiemale paratypes		Discovery collection							*N. gracillimum*
	♂1	♂2	♂ St. 27	♂ St. 123	♂ St. 160	♂ St. 140	♂1 St. 149	♂2 St. 149	♂3 St. 149	♂ holotype
L. of trunk (in mm.)	6·8	7·2	6·0	6·0	6·0	7·2	6·8	6·4	6·8	4·80
No. of spinules on fingers of chela	30–36		24, 29	27, 33	33, 38	34, 38	36, 40	30, 35	27, 33	22, 24
$\frac{\text{L. of palpal segments } 4+5}{\text{L. of segment } 2}$	1	1·06	0·87	1·05	1·0	1·08	1·02	1·0	0·81	0·85
No. of denticulate spines on oviger	42	43	31	40	38	40	36	36	34	33
Third leg:										
(*a*) $\frac{\text{L. of coxa } 2}{\text{L. of coxae } 1+3}$	1·64	1·95	2	1·80	1·90	2	2·30	1·60	2·2	2·1
(*b*) $\frac{\text{L. of tarsus}}{\text{L. of propodus}}$	0·89	1·0	0·83	0·97	1	1·06	1·04	1·16	1·25	1·33

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[1] Measurements of holotype in Calman, 1915, p. 32.

On the proximal ventral margin of the femur are 12–16 minute gland openings, on a level with the surface. Segments 4–6 of the oviger are in the proportions 1·6 : 2·8 : 1 (Fig. 13 *c*); the fifth segment is long, slender, slightly curved and narrowed proximally.

REMARKS. The holotype of *N. gracillimum*, Calman, is very closely related to, and may even be co-specific with, *N. hiemale*. In the Discovery collection there are many specimens that show characters intermediate between the two species (see Table IV), and one male from St. 149 that agrees very closely with the holotype of *N. gracillimum* (Table IV, St. 149, ♂$_3$). The femoral glands in the latter open on distinct tubercles; in the specimens referred to *N. hiemale* the gland openings are usually flush with the surface, but may be situated on faint, low tubercles.

DISTRIBUTION. This species has been recorded from the Ross Sea area (Hodgson, 1907; Calman, 1915); it is quite abundant around South Georgia and occurs as far south as Clarence Island.

Nymphon gracillimum, Calman (Figs. 12 *b* and 13 *a*).

Calman, 1915, p. 30, fig. 5 A–D.

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock, 200–234 m.; M. Large otter trawl: 1 ovigerous ♂.

The holotype differs from the types of *N. hiemale*, Hodgson, in the following respects. The proboscis is shorter than the cephalic segment; the two terminal segments of the palp measure 0·85 of the length of the second segment. There are twenty-two and twenty-four spinules respectively on each finger of the chela, and there is only a trace of the setose pad at the proximal end of the immovable finger. The tarsus is one and a third times the length of the propodus and the second coxa is 2·1 times the sum of the other two coxal segments. (The second tibia, as in *N. hiemale*, is nearly 1·5 times as long as the first.) There are thirty-three denticulate spines on the oviger, and the femoral gland openings are not flush with the ventral surface but situated at the apices of distinct low tubercles.

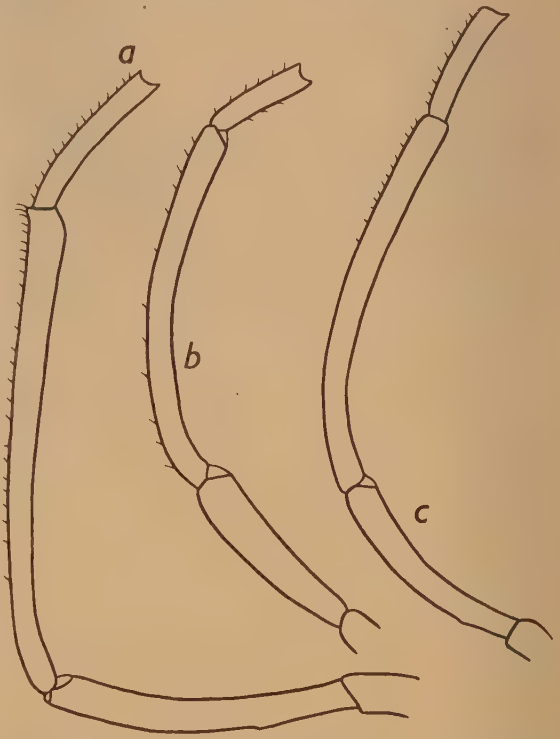

Fig. 13. Segments 4–6 of male oviger of: *a. Nymphon gracillimum*, Calman: × 20. *b. N. gracilipes*, Miers: × 15. *c. N. hiemale*, Hodgson: × 20.

The difference in the number of spines on the oviger may be due to the smaller size of the specimens (4·8 mm. as against 6·8–7·2 mm. in the types of *N. hiemale*).

In the Discovery collection there is one ovigerous male, measuring 6·8 mm. in length, that agrees very closely with the type of *N. gracillimum*. There are only thirty-four denticulate spines on the oviger; the two terminal palpal segments together are four-fifths of the second segment (Table IV, St. 149, ♂$_3$); the second coxa is 2·2 times the sum of the other two coxal segments. The femoral gland tubercles, however, are not quite so prominent as in the type; the tarsus is one-fourth as long again as the propodus. The number of spinules on each finger of the chela is twenty-seven and thirty-three respectively.

Measurements (mm.)

Length of proboscis	2·3
Diameter of proboscis	0·8
Length of trunk	6·8
Length of cephalic segment	3·2
Width of anterior cephalic lobes ...	1·2
Width of neck	0·53
Width across second lateral processes	3·2
Length of abdomen	0·7

Third leg:

First coxa	1·0
Second coxa	4·0
Third coxa	0·8
Femur	8·0
First tibia	10·0
Second tibia	14·5
Tarsus	2·0
Propodus	1·6
Claw	0·8
Auxiliaries	0·2

DISTRIBUTION. Previously recorded from McMurdo Sound.

Nymphon subtile, Loman (Figs. 14, 15 and 24 *b*).

Loman, 1923, pp. 14 and 19, fig. C.

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Island, from 7 miles N 50° E to 7·6 miles N 63° E of Eddystone Rock, 105–115 m.; f. S. Large otter trawl: 1 ♀ from kelp root.

St. WS 229. 1. vii. 28. 50° 35′ S, 57° 20′ W, 210–271 m.; f. gn. S. Commercial otter trawl: 2 ovigerous ♂♂, 2 young, with *Pallene australis*, n.sp.

St. WS 237. 7. vii. 28. 46° 00′ S, 60° 05′ W, 150–256 m.; c. br. S. Sh. Commercial otter trawl: 1 ♀, 1 ovigerous ♂.

St. WS 245. 18. vii. 28. 52° 36′ S, 63° 40′ W, 304–290 m.; d. gn. S. Sh. Commercial otter trawl: 1 ♀, 1 incomplete specimen.

DESCRIPTION OF MALE. *Trunk* loosely built, lateral processes separated by wide intervals (one and a half to two and a half times their own diameter). Cephalic segment approximately equal to the sum of the three posterior segments; neck long; oviger base small and in contact with first lateral process. Ocular tubercle wide, low and rounded; eyes conspicuous. Setae absent (Fig. 15 *a*).

Proboscis short, sub-cylindrical; nearly equal to, though apparently much shorter than, scape (from dorsal aspect); foreshortened in Fig. 15 *a*.

Abdomen short, reaching to distal end of fourth lateral process or a little beyond; elevated at an angle of about 35°.

Chelophore. Scape shorter than chela, length four and a half times the distal width. Fingers rather longer than palm each armed with eighteen and twenty-two spinules respectively (Fig. 14 *b*).

Palp. Third segment four-fifths of, two terminal segments together equal to, second (Fig. 14 *c*).

Oviger. Terminal claw approximately half of tenth segment, armed with five spinules. Total number of denticulate spines 32 (9 + 8 + 7 + 8). Segments 4–6 in the proportions 1·5 : 2·5 : 1; fifth segment long, curved, and of almost uniform diameter throughout (Fig. 14 *a*).

Third leg slender and sparsely setose. Second coxa longer than the sum of the other two (dorsal measurements—1·5–1·75 : 1). Femur shorter than either tibia; there appear to be 8–9 minute gland openings on proximal two-thirds of mid-ventral surface but no raised tubercles. Second tibia the longest segment. Tarsus half to two-thirds of propodus; claw short, about one-third of propodus, auxiliaries well developed (half to two-thirds of main claw). Numerous small spinose setae on ventral margin of tarsus and of propodus (Fig. 24 *b*).

Female. The femur and second coxa are more robust and segments 4–6 of the oviger are relatively short and almost straight, in the proportions 1·88 : 2·25 : 1. The second coxa is never more than half as long again as the sum of the other two.

Measurements (*mm.*)

	♂ (WS 237)	♀ (WS 245)
Length of proboscis	0·6	0·85
Diameter of proboscis	0·4	0·47
Length of trunk	2·4	2·6
Length of cephalic segment	1·2	1·25
Width of cephalic lobes	0·6	0·6
Width of neck	0·25	0·27
Width across second lateral processes	1·6	1·4
Length of abdomen	0·4	0·35
Third leg:		
First coxa	0·4	0·4
Second coxa	1·3	1·0
Third coxa	0·35	0·3
Femur	2·5	2·4
First tibia	2·9	2·7
Second tibia	3·75	3·4
Tarsus	0·7	0·5
Propodus	1·1	1·0
Claw	0·35	0·34
Auxiliaries	0·25	0·2

REMARKS. These specimens agree closely with Loman's description (1923, p. 19) of the holotype, an ovigerous male. The number of denticulate spines on the oviger varies from twenty-four to thirty-six, the number of spinules on the fingers of the chela from fourteen to twenty-four.

This species is most closely allied to *N. pfefferi*, Loman, and *N. paucidens*, n.sp. (especially to the former), but differs from both in that the neck is longer and the number of denticulate spines is higher. *N. adareanum*, Hodgson, has the same type of male oviger (see Table III), but it differs from all other *Nymphon* species in having simple spines on the four terminal segments (see Gordon, 1932, p. 98).

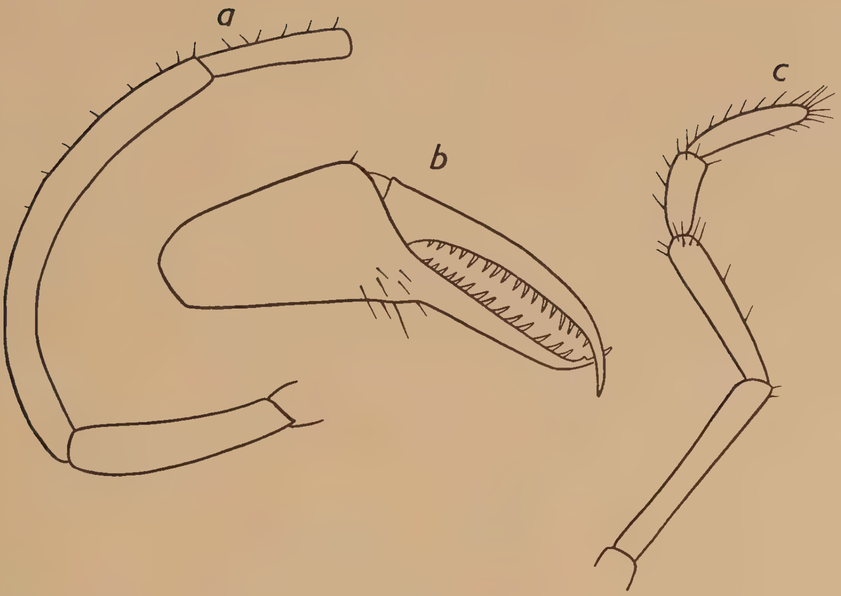

Fig. 14. *Nymphon subtile*, Loman: *a*. Segments 4–6 of male oviger. *b*. Chela. *c*. Palp.

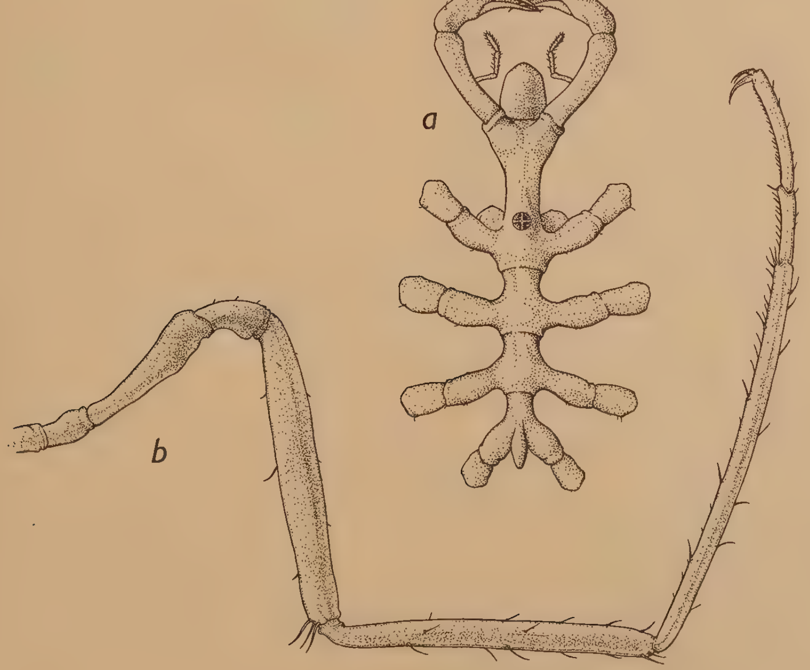

Fig. 15. *Nymphon subtile*, Loman: *a*. Dorsal view of body with chelophores and palps—proboscis fore-shortened. *b*. Third leg of female from St. 51.

Nymphon pfefferi (Pfeffer), Loman (Figs. 16, 17 *b*, *d* and 18 *a*, *b*, *d*).

N. antarcticum, Pfeffer, 1889, *Jahrb. Hamburg Wiss. Anst.*, VI, Heft 2, p. 42.
N. pfefferi, n.n., Loman, 1923, p. 17, fig. B.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point, to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 2 immature specimens.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 6 specimens.

St. 141. 29. xii. 26. East Cumberland Bay, South Georgia, 200 yards from shore, under Mount Duse, 17–27 m.; M. Small beam trawl: 1 ♂.

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock, 200–234 m.; M. Large otter trawl: 1 ♀.

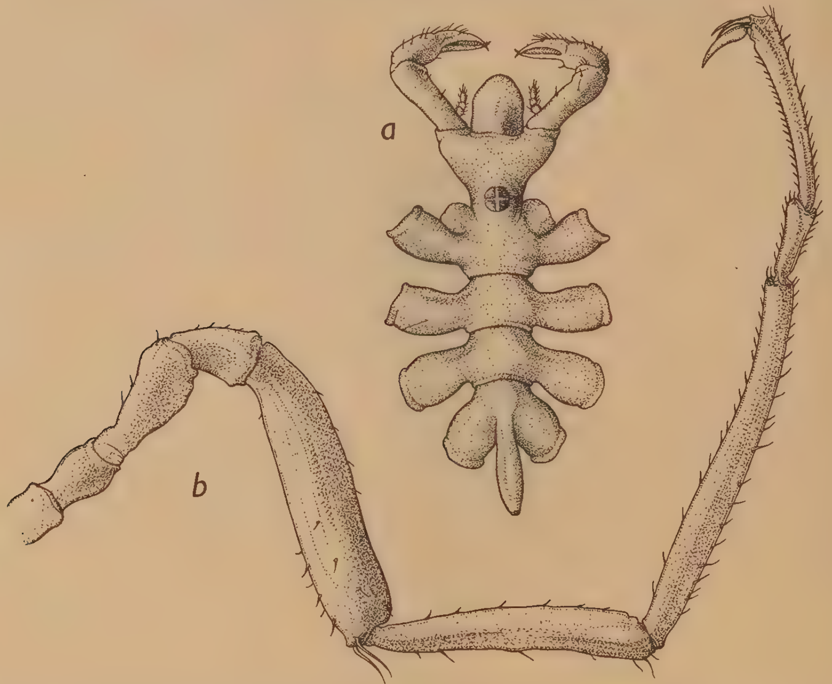

Fig. 16. *Nymphon pfefferi*, Loman: *a*. Dorsal view of body of male from St. 141, with chelophores and palps: × 40. *b*. Third leg of female from St. 149.

DESCRIPTION OF MALE. *Trunk* with lateral processes separated by their own diameter as a rule. Neck short, almost entirely occupied laterally by the base of the oviger; cephalon much expanded anteriorly. Ocular tubercle low, wide, rounded; eyes conspicuous. Setae absent (Fig. 16 *a*).

Proboscis short; subequal to, or shorter than scape, and half to three-fifths of cephalic segment.

Abdomen long, slender; reaching to distal end of first coxa; elevated at an angle of about 30°.

Chelophore. Scape short, length two and a half to three times the distal width. Chela subequal to scape; fingers one-third as long again as palm armed each with 19–30 spinules; setose pad extending half-way along immovable finger (Fig. 17 *b* and *d*).

Palp. Terminal longer than penultimate segment, both setose (Fig. 18 *b*). Two terminal segments together equal to third, and a little shorter than second segment.

Oviger. Terminal claw equal to tenth segment and armed with 5–7 spinules. Total number of denticulate spines 19–22. Segments 4–6 in the proportions 1·3 : 1·73 : 1 (Fig. 18 *a*); fifth segment curved and of almost uniform diameter throughout.

Third leg. Second coxa a little longer than the sum of the other two. Femur slightly shorter than first tibia; four low wide gland tubercles on proximal half of ventral margin. Second tibia the longest segment. Tarsus short, approximately one-third of propodus; claw short; auxiliaries long ($\frac{1}{2}$–$\frac{3}{4}$ of claw). A number of rather long setae on coxae, femur and first tibia, those on the distal segments shorter and more numerous.

FEMALE. The femur is more robust, the coxae less setose and segments 4–6 of oviger relatively short and straight (1·33 : 1·33 : 1).

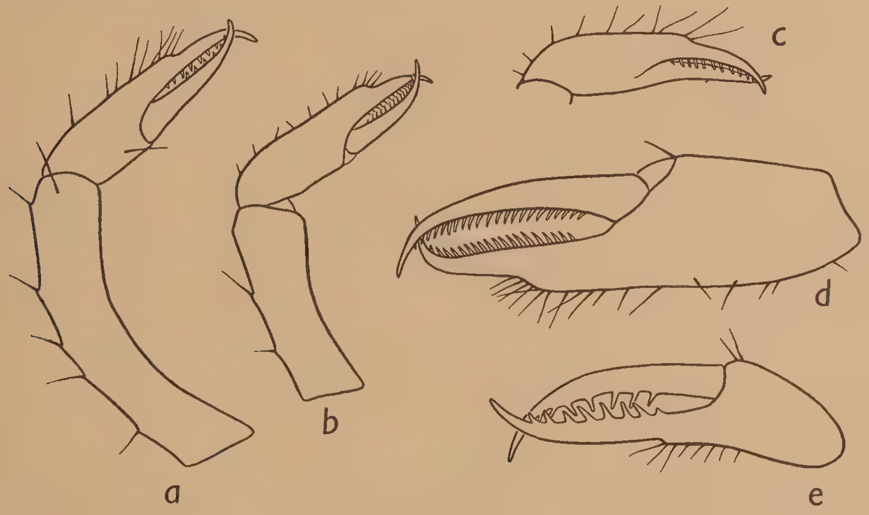

Fig. 17. *Nymphon pfefferi*, Loman: *b*. Chelophore of young specimen (length = 1·4 mm.). *d*. Chela of adult co-type.
N. paucidens, n.sp.: *a*. Chelophore of young specimen (length = 1·8 mm.). *e*. Chela of adult: × 60.
N. tridentatum, Hodgson: *c*. Chela of holotype (young).

Measurements (mm.)

	♂ (St. 141)	♀ (St. 149)
Length of proboscis	0·5	0·87
Diameter of proboscis	0·35	0·45
Length of trunk	2·0	2·2
Length of cephalic segment	1·0	1·0
Width of cephalic lobes	0·8	0·9
Width across second lateral processes	1·65	1·65
Length of abdomen	0·8	0·85
Third leg:		
Coxae	1·8	1·8
Femur	1·95	2·1
First tibia	2·2	2·2
Second tibia	2·8	2·8
Tarsus	0·45	0·45
Propodus	1·35	1·37
Claw	0·4	0·5
Auxiliaries	0·3	0·3

REMARKS. This small species has only once been figured, and that rather poorly, by Loman (1923, fig. B). The Discovery specimens agree well with co-types in the Hamburg Museum. The proboscis varies considerably in relative length (e.g. the trunk is four times as long as the proboscis in the male, and only two and a half times in the female measured), and may be rather longer or shorter than the scape.

The differences between this species and *N. paucidens* are listed on p. 51, and illustrated in Figs. 16–20.

Loman (1923, p. 18) suggested that *N. tridentatum*, Hodgson, may be a young specimen of *N. pfefferi*. This is very probable; the chelophore is of the same type with eleven spinules on the immovable, twelve or thirteen on the movable finger (Fig. 17 *c*); the ratio of tarsus to propodus is about the same (Fig. 18 *c*) and the proportions of the palpal segments are very similar. The specimen is very immature, the total[1] length being only 1 mm.; it has a longer neck and longer setae on the distal segments of the legs than are typical of adult specimens of *N. pfefferi*.

Nymphon paucidens, n.sp. (Figs. 17 *a*, *e*, 19 and 20).

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock, 179–235 m.; gy. M. Large otter trawl: 1 ♂, holotype.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point, to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 2 ♂♂, 1 ♀, 2 immature specimens.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 1 ♀ and 3 immature specimens.

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock, 200–234 m.; M. Large otter trawl: 2 ♂♂, one carrying two egg-masses on the left oviger.

St. MS 74. 17. iii. 26. East Cumberland Bay, 1 cable SE × E of Hope Point to 3·1 miles SW of Merton Rock, 22–40 m. Small beam trawl: 1 immature specimen.

DESCRIPTION OF HOLOTYPE (♂). *Trunk* with lateral processes separated by their own diameter or rather more. Cephalic segment approximately equal to the sum of the three posterior segments; neck short, base of oviger in contact with first lateral process and occupying posterior half of neck (Fig. 19 *a*). Ocular tubercle rather higher than wide, rounded; situated a little in front of first lateral processes.

Proboscis sub-cylindrical, rounded at apex; two-thirds of cephalic segment (dorsal aspect).

Abdomen long, narrow, pyriform; extending a little beyond distal end of first coxa; elevated at an angle of about 40°.

Palp setose. Second segment somewhat longer than, two terminal segments together equal to, third (Fig. 20 *b*).

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[1] I.e. including proboscis and abdomen.

Chelophore. Scape longer than proboscis, length nearly six times the distal width. Chela a little shorter than scape; palm very short; each finger armed with only 7–9 long spinules (Fig. 17 *a*, *e*).

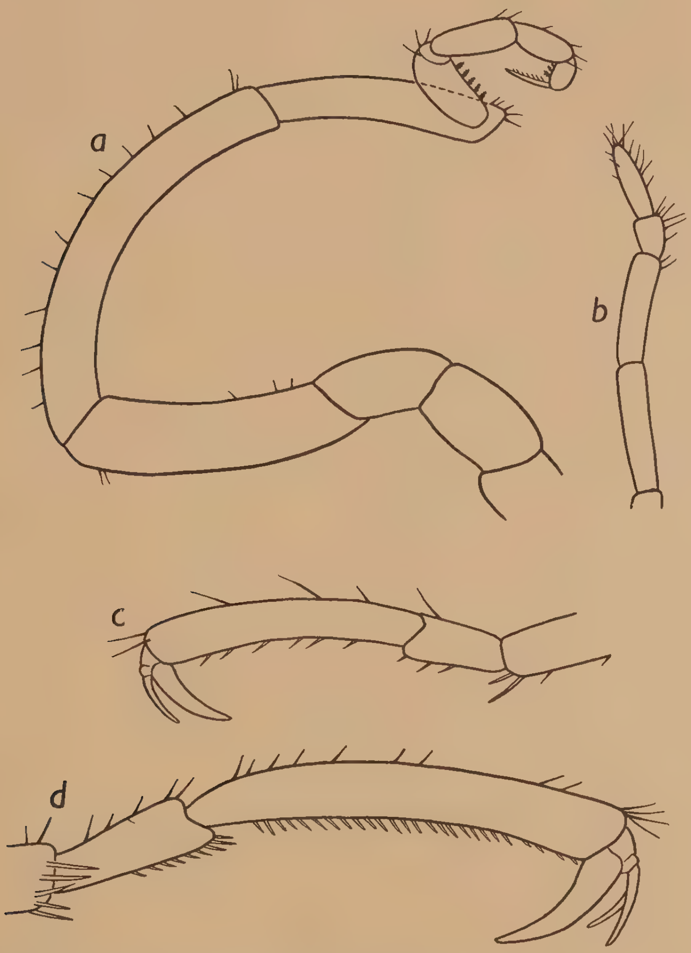

Fig. 18. *Nymphon pfefferi*, Loman: *a.* Oviger of male from St. 141: × 70. *b.* Palp of a rather small specimen from St. 140: × 90. *d.* Terminal segments of third leg of a co-type. *N. tridentatum*, Hodgson: *c.* Terminal segments of fourth leg of holotype.

Oviger. Terminal claw equal to tenth segment armed with five long, slender spinules. Total number of denticulate spines 17–20. Segments 4–6 in the proportions 2·2 : 2·87 : 1, fifth segment slender, curved, and of almost uniform diameter throughout.

Third leg slender, with numerous long, fine setae, especially on the three longest segments. Second coxa a little longer than the sum of the other two. Femur shorter than either tibia; four low wide gland tubercles on proximal half of ventral surface. Second tibia the longest segment. Tarsus half of propodus; auxiliaries half as long as main claw (Fig. 20, cf. 19 *b*).

The *female* has the walking legs, especially as regards the femur, a little more robust

(Fig. 19 *b*). Segments 4–6 of the oviger are straight and relatively short, in the proportions 1·75 : 1·5 : 1. Otherwise it agrees with the male.

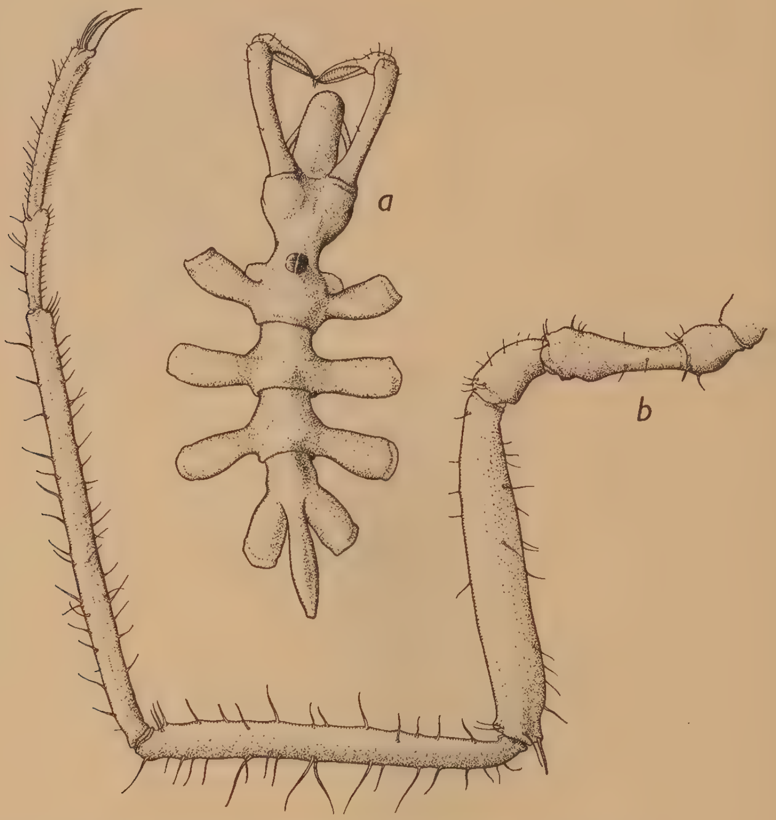

Fig. 19. *Nymphon paucidens*, n.sp. *a*. Dorsal view of body of holotype with chelophores: × 20—proboscis foreshortened. *b*. Third leg of female from St. 140.

Measurements (mm.)

	♂ holotype	♀ (St. 140)
Length of proboscis	0·7	0·8
Diameter of proboscis	0·35	0·37
Length of trunk	2·4	2·5
Length of cephalic segment	1·1	1·2
Width of cephalic lobes	0·7	0·75
Width across second lateral processes	1·6	1·6
Length of abdomen	0·85	1·0
Third leg		
Coxae	2·0	1·9
Femur	2·4	2·5
First tibia	2·8	2·8
Second tibia	3·4	3·2
Tarsus	0·6	0·6
Propodus	1·2	1·3
Claw	0·45	0·45
Auxiliaries	0·25	0·25

Remarks. This small species may be distinguished from *N. pfefferi*, Loman, with which it occurred in two localities, as follows. (1) The trunk is less compact and the cephalon less expanded anteriorly (cf. Figs. 16 *a* and 19 *a*). (2) The legs are more slender and setose (cf. Figs. 16 *b* and 19 *b*) and the tarsus is consistently longer in proportion to the propodus (one-half and one-third respectively). (3) The scape of the chelophore is longer and more slender (cf. Fig. 17 *a* and *b*); the palm is much shorter and there are fewer spinules on the fingers of the chela (cf. Fig. 17 *e* and *d*). Even in very small specimens these differences are apparent, and when the trunk length is only 1·4 mm. there are already 15–16 spinules on the fingers of the chela in *N. pfefferi* (Fig. 17 *a*, cf. Fig. 17 *b*). (4) The male oviger is more slender and segment 6 is relatively short—half as long as, instead of subequal to, segment 4 (Figs. 20 *a* and 18 *a*).

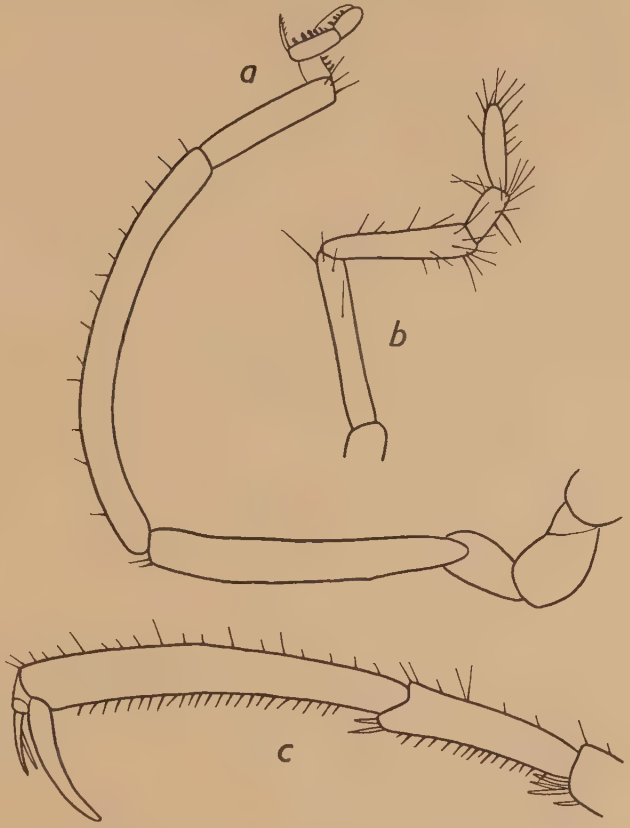

Fig. 20. *Nymphon paucidens*, n.sp.: *a*. Oviger of holotype: × 47. *b*. Palp of holotype: × 60. *c*. Terminal segments of third leg of female: × 47.

Nymphon charcoti, Bouvier (Fig. 10 *b*).

N. charcoti, Bouvier, 1911, p. 1138; 1913, p. 81, text-figs. 32–34.
N. charcoti, Calman, 1915, p. 29.
N. charcoti, Loman, 1923, p. 15.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock, 179–235 m.; gy. M. Large otter trawl: 17 specimens, including ovigerous and larvigerous ♂♂, several with encrusting Polyzoa.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light, to 4 miles N 39° E of Jason Light, 120–204 m., M. Large otter trawl: 7 large (1 with encrusting Polyzoa) and many small specimens.

St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 238–270 m.; gy. M. Large otter trawl: many specimens of all sizes, some males larvigerous, a few with encrusting Polyzoa (with *N. australe*). A number of the smaller specimens are soft.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 1 ♂, 3 ♀♀ and several immature specimens.

St. 142. 30. xii. 26. East Cumberland Bay, South Georgia, from 54° 11′ 30″ S, 36° 35′ W to 54° 12′ S, 36° 29′ 30″ W, 88–273 m., M. Large otter trawl: 3 specimens, 1 ovigerous, 1 overgrown with Hydroids, the third very soft.

St. 143. 30. xii. 26. Off mouth of East Cumberland Bay, South Georgia, 54° 12′ S, 36° 29′ 30″ W, 273 m. Large otter trawl: 2 ♀♀, 1 ♂ (ovigerous and with 1 large and several small Isopods attached), 1 immature.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W, 155–178 m.; gn. M. S. Large otter trawl: 1 ♂ (soft).

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock, 200–234 m.; M. Large otter trawl: 1 ♀ and 4 immature specimens.

St. 154. 18. i. 27. Jason Harbour to Larsen Point, South Georgia, from 2·6 miles S 84° W to 5½ cables S 26° E of Larsen Point, 60–160 m.; M. Large dredge: several adult and immature specimens, including 1 ovigerous ♂.

St. 156. 20. i. 27. 53° 51′ S, 36° 21′ 30″ W, 200–236 m.; R. Large dredge: 1 ♂, 1 ♀ (claw short).

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 2 specimens, 1 very flabby (claw short).

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ S, 58° 28′ 30″ W, 391 m.; M. St. Medium otter trawl: at least a hundred specimens of all sizes.

St. WS 32. 21. xii. 26. Mouth of Drygalski Fjord, South Georgia, 91–225 m.; gy. M. Small beam trawl: 1 ♀.

St. MS 68. 2. iii. 25. East Cumberland Bay, South Georgia, 1·7 miles S ½ E to 8½ cables SE × E of Sappho Point, 220–247 m. Large rectangular net: many specimens of all sizes including ovigerous and larvigerous ♂♂, one is overgrown with a compound Tunicate and Hydroids, one has an Isopod attached.

DESCRIPTION OF MALE. *Trunk* with lateral processes separated by a considerable interval (0·6–1·5 of their own diameter). Neck rather long, base of oviger large and in contact with, or a little in front of, first lateral process. Ocular tubercle as wide as, or even wider than high; eyes conspicuous.

Proboscis expanded somewhat in middle and again at apex; subequal to scape and slightly shorter than cephalic segment.

Abdomen short, scarcely reaching to distal end of fourth lateral process, elevated at an angle of about 30°.

Chelophore. Scape shorter than the curved chela, length four and a half times the distal width, bearing a number of short, stout setae. Palm long, narrow, and provided with a number of short setae along mid-dorsal surface. Fingers rather longer than, and at an angle of about 45° to, palm; 65–90 crowded spinules on immovable, 75–110 on movable finger.

Palp long and slender; segments 2–5 subequal; in the proportions 10 : 10 : 11 : 10 and 12 : 14 : 13 : 14·5.

Oviger. Terminal claw a little more than half of tenth segment and armed with 10–16 long spinules. Total number of denticulate spines in adults 40–51. Segments 4–6 in the proportions 1 : 1·71 : 1; fifth segment slightly curved and contracted in proximal third, sixth segment bent in a very open S curve (Fig. 73).

Third leg. Second coxa a little longer than the sum of the other two. Femur shorter than either tibia; gland openings very minute, and numerous (exceeding twenty in the larger males) on proximal mid-ventral surface; raised gland tubercles absent. Second tibia the longest segment. Tarsus and propodus elongated, subequal; in adults the tarsus is longer than, in immature forms a little shorter than the propodus (see Table V). Claw long, subequal to propodus in immature specimens, appreciably shorter than, occasionally less than half of, propodus in adults (see Table V); auxiliaries absent. The legs, as a rule, appear smooth or very slightly setose to the eye.

Table V

Station	Sex	Relative lengths of		
		Tarsus	Propodus	Claw
MS 68	♂	1·38	1	0·81
39	♂	1·33	1	0·71
143	♀	1·28	1	0·72
156	♀	1·40	1	0·58
170	♀	1·23	1	0·44
195	♂	1·17	1	0·68
195	♀	1·30	1	0·74
195	Immature*	1·03	1	0·88
195	,,	0·96	1	1·06
195	,,	0·85	1	1·03
195	,,	0·84	1	1·03

* The immature forms decrease gradually in size, the last measures only 4·4 mm. from front of cephalon to tip of abdomen, the first is approximately twice as long.

REMARKS. This species is exceedingly common on the western side of the Antarctic and is also one of the largest of the genus (trunk length up to 18·5 mm.). The Discovery specimens agree in most respects with Bouvier's description (1913, p. 81); but the femur of the male is similar to that of the female, not dilated (see Calman, 1915, p. 29).

Very few specimens have been collected on the eastern side. The three Terra Nova specimens from St. 294 (Calman, 1915, p. 29) differ from the Discovery specimens of the same size (length of trunk 12–13 mm.) in the following respects: (1) the legs are clothed with numerous fine setae, (2) there are only 30 or 31, instead of 41–44 denticulate spines on the oviger, and (3) the fingers of the chela are armed with 70–85 instead of 90–110 spinules. These three specimens are closely related to, if not identical with, the types of *N. lanare*, Hodgson (see also Loman, 1923, p. 15). Unfortunately the type specimens of Hodgson's species are immature, but they differ from immature *N. charcoti* (South Georgia region) precisely in the three above-mentioned respects. These differences seemed to point to the existence of a distinct variety or race peculiar to the Ross Sea area, but the Terra Nova specimen from St. 349 proved to be identical with the typical *N. charcoti* from the Western Antarctic region. Until more material is available from the eastern region it seems advisable to refer the three Terra Nova specimens (St. 249) to *N. lanare*, Hodgson, and to retain the name *N. lanare* for those specimens that have 10–13 fewer denticulate spines on the oviger, 20–25 fewer spinules on each finger of the chela, and more hairy legs than *N. charcoti*.

Distribution. Previously recorded from South Shetlands, Southern Chili, Ross Sea and McMurdo Sound; South Georgia.

Nymphon clarencei, n.sp. (Figs. 21, 22 and 23 *b*).

St. 160. 7. ii. 27. Near Shag Rocks, 53° 43′ 40″ S, 40° 57′ 00″ W, 177 m.; gy. M. R. St. Large dredge: 1 ovigerous ♂.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ 00″ W, 342 m.; R. Large dredge: 1 ♀, 1 ♂ (holotype), 1 ovigerous ♂ with encrusting Polyzoa and 1 larvigerous ♂.

St. WS 27. 19. xii. 26. 53° 55′ S, 38° 01′ W, 1 metre horizontal tow-net, 106–9 m. (net touched bottom): 1 ♂, 1 ♀, 1 immature specimen.

Description of holotype. *Trunk* with lateral processes separated by considerable intervals (one-third of, to approximately their own diameter). Neck rather short, posterior half bearing the large base of the oviger; ocular tubercle as wide as high; eyes conspicuous (Fig. 21).

Proboscis short, stout, sub-cylindrical; three-fourths of cephalic segment, subequal to scape.

Abdomen short, reaching to distal end of fourth lateral process; elevated at an angle of about 30°.

Chelophore. Scape gradually widening distally; length three and a half times the maximum width. Chela equal to (or slightly longer than) scape; fingers slightly longer than palm, armed with thirty-two and thirty-seven spinules respectively, setose pad extending on to proximal fourth of immovable one (Fig. 22 *b*).

Segments 2–5 of *palp* in the proportions 7·66 : 8·33 : 4 : 6; in another ♂ 8 : 8 : 4 : 5 (Fig. 22 *c*).

Oviger. Terminal claw a little shorter than tenth segment and armed with seven spinules. Total number of denticulate spines 35 (13 + 8 + 7 + 7). Segments 4–6 in the proportions[1] 1·78 : 3·11 : 1; fifth segment long, slender and somewhat clubbed distally; sixth segment slightly curved (Fig. 23 *b*).

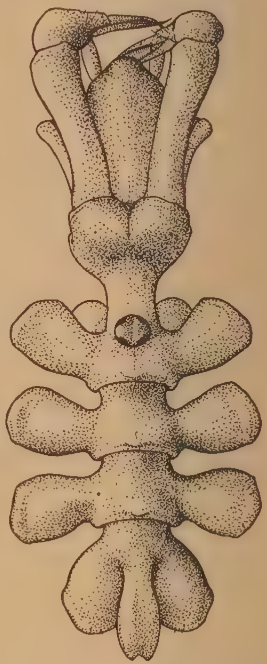

Fig. 21. *Nymphon clarencei*, n.sp. Dorsal view of body with chelophores and palps: × 8.

Third leg. Second coxa long, twice the sum of the other two. Femur slightly shorter than first tibia, 10–11 gland openings, flush with surface, on the proximal mid-ventral surface. Second tibia the longest segment, approximately half as long again as femur. Tarsus two-thirds of propodus, 6–9 long spines on the ventral margin of the latter. Claw nearly half of propodus; auxiliaries well developed (Fig. 22 *a*).

Paratypes. The males all agree very closely with the holotype. In the female the coxae, femur and first tibia of the walking legs are more robust; the second coxa is considerably shorter, less than half as long again as the sum of the other two

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[1] 1·6 : 2·8 : 1 in the male from St. WS 27.

(1·24–1·40 : 1); segments 4–6 of the oviger are relatively short, in the proportions 1·31 : 1·75 : 1.

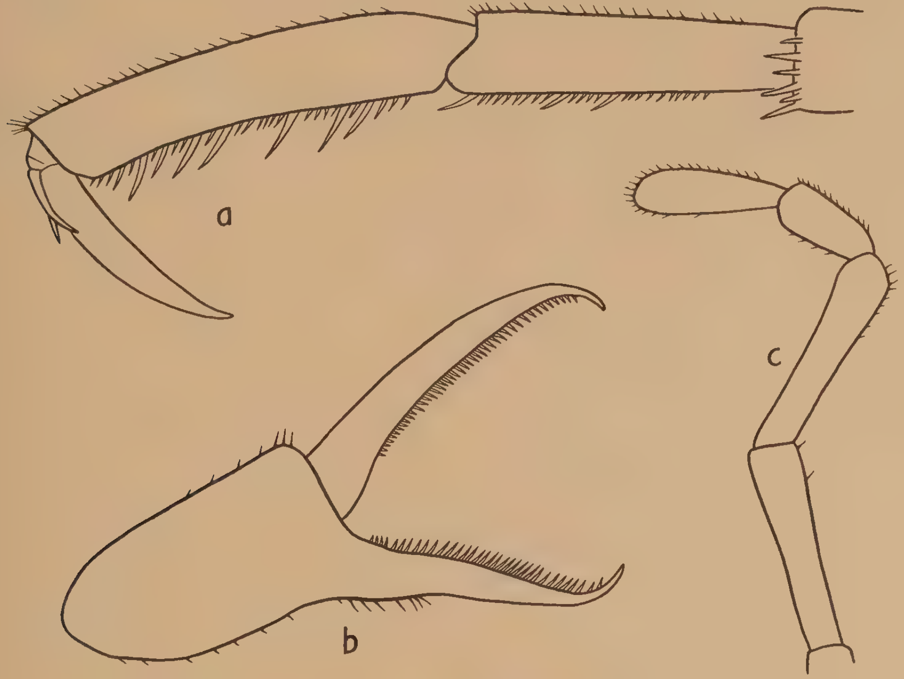

Fig. 22. *Nymphon clarencei*, n.sp.: *a*. Terminal segments of third leg: × 27. *b*. Chela: × 27. *c*. Palp: × 20.

Measurements (mm.)

	Holotype St. 170	Ovig. ♂ St. 170	♀ St. 170
Length of proboscis	2·4	2·2	2·4
Diameter of proboscis	1·2	1·2	1·2
Length of trunk	6·8	6·4	6·4
Length of cephalic segment	3·4	3·2	3·2
Width of anterior cephalic lobes	1·8	1·8	2·13
Width of neck	0·8	0·9	0·8
Width across second lateral processes	4·0	4·2	4·0
Length of abdomen	1·05	1·0	1·2
Third leg:			
First coxa	1·2	1·2	1·3
Second coxa	4·0	4·0	2·6
Third coxa	0·8	0·8	0·8
Femur	8·4	7·8	8·0
First tibia	9·0	8·65	8·6
Second tibia	13·2	11·4	11·6
Tarsus	1·7	1·4	1·6
Propodus	2·5	2·25	2·5
Claw	1·05	1·0	1·3
Auxiliaries	0·4	0·4	0·4
No. of denticulate spines on oviger	35	40	37
Approximate no. of spinules on chela	32 and 37	30 and 35	35 and 43

Remarks. This species bears a strong superficial resemblance to *N. hiemale*, Hodgson, but in addition to being a more robust form, it differs from the latter in the following respects: (1) the third palpal segment is equal to or a little longer than the second, (2) the tarsus never exceeds two-thirds of the propodus, (3) the fifth segment of the male oviger, though long, is expanded distally and is very similar to that of *N. brachyrhynchum*, Hoek (Gordon, 1932, fig. 4 *a*). It is easily distinguished from the latter as follows: (1) the chela is subequal to, instead of half as long again as, the scape; the fingers are not bent distally and are armed with fewer spinules (cf. Fig. 22 *b* with Gordon, 1932, fig. 3); (2) the relative proportions of palpal segments 2–5 differ markedly in the two species (e.g. 7·66 : 8·33 : 4 : 6 and in *N. brachyrhynchum* 8 : 11 : 12 : 8); (3) the relative proportions[1] of segments 4–6 of the male oviger are different.

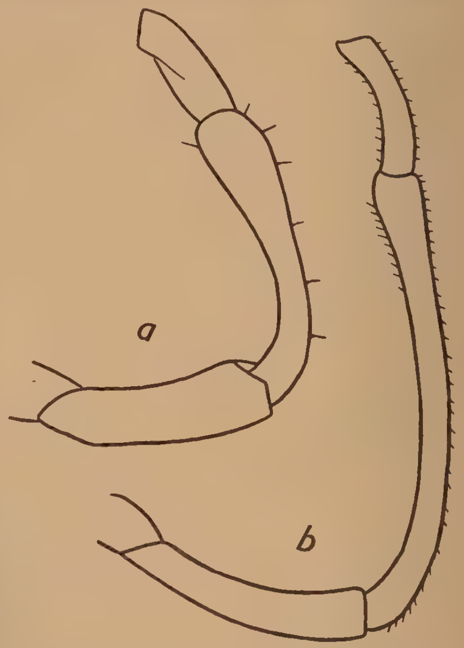

Fig. 23. Segments 4–6 of male oviger of: *a. Nymphon articulare*, Hodgson (sixth segment slightly twisted): × 36. *b. N. clarencei*, n.sp.: × 10.

Nymphon, sp.? (Fig. 24 *e*, *f*).

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W, 160–335 m.; M. Large otter trawl: 1 ♂, incomplete.

Description of specimen. *Trunk* slender, smooth and of very loose build; lateral processes separated by 2–3 times their own diameter. Neck long and slender; ocular tubercle low, as wide as high; eyes conspicuous.

Proboscis long, rather slender, slightly expanded in middle and again near the distal end; approximately two-thirds of cephalon and a little shorter than scape.

Abdomen very short, reaching only to about the middle of fourth lateral process; elevated at an angle of about 45°.

Chelophore long and slender. Scape approximately seven times as long as wide distally, bearing a very few short setae especially near the distal articulation. Chela rather longer than scape (5 : 4) and slightly curved; fingers half as long again as palm, each armed with about 50–52 crowded and uneven spinules (every 2nd–4th spinule long, the intermediate ones of various lengths). Setose pad scarcely developed (Fig. 24 *f*).

Palp long and slender, segments 2–5 subequal in the proportions 4·25 : 4·5 : 4·5 : 4·75; setae very minute.

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[1] In *N. brachyrhynchum* 2·5 : 4 : 1 and 2·33 : 3·66 : 1.

Oviger long and slender. Terminal claw three-fifths of tenth segment and armed with 7–8 spinules. Total number of denticulate spines 30 (12 + 7 + 5 + 6). Segments 4–6 in the proportions 1·33 : 2 : 1; segment 6 long and slightly curved (Fig. 24 *e*).

Leg. Only the two anterior pairs of legs are complete. The second coxa is long, 1·66 and 2 times the sum of the first and third (see measurements). The femur is shorter than either tibia, with a row of about twenty-four very low, crowded gland tubercles on the proximal two-thirds. Second tibia the longest segment. Tarsus propodus and claw elongated and slender; claw equal to or a little shorter than the propodus which is approximately *half* of the tarsus. Auxiliaries absent.

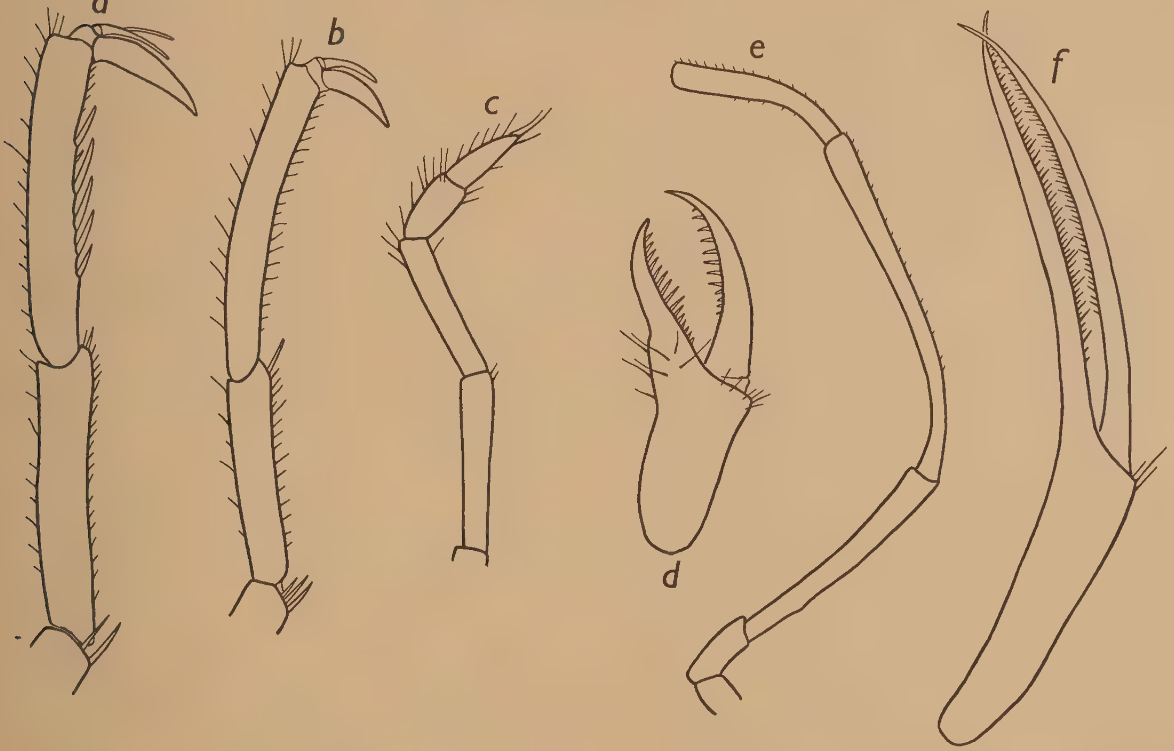

Fig. 24. *Nymphon subtile*, Loman: *b*. Terminal segments of third leg.
Nymphon sp.? St. 53: *a*. Terminal segments of third leg: × 47. *c*. Palp: × 60. *d*. Chela: × 47.
Nymphon sp.? St. 181: *e*. Segments 2–6 of male oviger: × 16. *f*. Chela: × 16.

Measurements (mm.)

Length of proboscis	2·4
Diameter of proboscis	0·8
Length of trunk	6·93
Length of cephalic segment	3·4
Width of anterior cephalic lobes	1·22
Width of neck	0·43
Width across second lateral processes	3·6
Length of abdomen	0·65

Walking leg:	(1st)	(2nd)
First coxa	1·2	1·2
Second coxa	3·0	3·6
Third coxa	0·6	0·6
Femur	8·8	
First tibia	10·4	
Second tibia	13·0	
Tarsus	4·2	3·73
Propodus	2·1	2·0
Claw	1·87	2·0

REMARKS. This species belongs to group I, but the oviger is somewhat transitional between type I *b* and type I since the fifth segment is gradually expanded towards the distal end. On the whole, the specimen is more nearly related to *N. longicoxa* and *N. hamatum* than to *N. proceroides* and *N. tenuipes* (forms in which the auxiliary claws are absent). The chela is long and slender, and the sixth segment of the oviger is curved, as in the two first-named forms, but *Nymphon* sp.? may be easily distinguished from both by the palp which is very similar to that of *N. charcoti*; the second coxa and the tarsus are both relatively much longer than in that species (cf. also the ovigers, Figs. 10 *b* and 24 *e*). The tarsus is longer than in any other species in group I.

Nymphon, sp.? (Fig. 24 *a*, *c* and *d*).

St. 53. 12. v. 26. Port Stanley, East Falkland Island. Hulk of 'Great Britain': 1 ♀.

DESCRIPTION. *Trunk* rather compact; lateral processes separated by approximately their own diameter. Neck short; oviger base large, in contact with first lateral process. Ocular tubercle rather higher than wide; eyes conspicuous. Setae absent.

Proboscis short, stout, sub-cylindrical, rounded at apex; two-thirds of cephalic segment, and three-fourths of scape.

Abdomen reaching a short distance beyond fourth lateral process, elevated at an angle of 45°.

Chelophore. Scape four times as long as wide distally, bearing a few very fine setae. Chela subequal to scape; movable finger subequal to palm armed with eleven or twelve spinules; 15 spinules on immovable finger (Fig. 24 *d*).

Palp as represented in Fig. 24 *c*, two terminal segments together approximately four-fifths of second segment.

Oviger. Terminal claw rather more than half of tenth segment, armed with about seven spinules. Total number of denticulate spines 37 (11 + 10 + 7 + 9). Segments 4–6 short, in the proportions 1·5 : 2 : 1.

Third leg. Second coxa 1·4 times the sum of the first and third. Femur nine times as long as wide, subequal to first tibia. Second tibia the longest segment. Tarsus seven-tenths of propodus, ventral margin of the latter spinose (Fig. 24 *a*). Claw rather more than one-third of propodus, auxiliaries long, two-thirds of main claw. Setae few in number and very fine. There are long irregular patches of a light brownish or purplish colour on each of the three main segments.

Measurements (*mm.*)

Length of proboscis	0·6
Diameter of proboscis	0·33
Length of trunk	1·8
Length of cephalic segment	0·9
Width of anterior cephalic lobes ...	0·58
Width of neck	0·3
Width across second lateral processes	1·2
Length of abdomen	0·35

Third leg:	
First coxa	0·35
Second coxa	1·1
Third coxa	0·42
Femur	3·0
First tibia	3·13
Second tibia	3·9
Tarsus	0·77
Propodus	1·05
Claw	0·4
Auxiliaries	0·37

Remarks. Although it is extremely small, this specimen is a mature female with developing ova in the femur of each leg. The male is unknown, so that the affinities of the species are uncertain, but it would appear to be allied to *N. subtile*, Loman. It differs from the latter, however, in several respects: (1) the body is more compactly built with a much shorter neck, (2) the legs are much longer relative to the size of the specimen, being 7·6 times as long as the trunk (as against 5·4 and 4·6 in the male and female respectively of *N. subtile*—see measurements), (3) the tarsus is longer relative to the propodus and the ventral margin of the latter is armed with five spines, (4) the two terminal palpal segments are shorter, and (5) the legs are characterized by the presence of long bands of a darkish colour.

This species shows affinities with some of the northern forms, e.g. *N. brevitarse*, Kröyer (Sars, 1891, pl. v, fig. 3).

B. GROUP II

Nymphon australe, Hodgson (Figs. 25 *d* and 26 *b*).

N. australe, Hodgson, 1902, p. 257, pl. xl.
Chaetonymphon altioculum, Möbius, 1902, p. 181, pl. xxvi, figs. 1–6.
Ch. australe, Hodgson, 1907, p. 32, pl. x, fig. 14.
Ch. australe var. *austrinorum*, Hodgson, 1907, p. 35, pl. iv, fig. 4; pl. x, fig. 15.
Ch. assimile, Hodgson, 1908, p. 175, pl. i, figs. 1, 1 *a*.
N. stylops, Bouvier, 1911, p. 1137; 1913, p. 73, text-figs. 25–31.
N. australe, Calman, 1915, p. 36.
Ch. australe var. *austrinorum*, Loman, 1923, p. 21.

St. WS 32. 21. xii. 26. Mouth of Drygalski Fjord, South Georgia, 91–225 m.; gy. M. Small beam trawl: many specimens, including ovigerous and larvigerous ♂♂.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m.; M. Large otter trawl: 20 specimens, some brown, 1 with Polyzoa.

St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 238–270 m.; gy. M. Large otter trawl: hundreds of specimens, many with encrusting Polyzoa.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 230–250 m.; gy. M. Large otter trawl: 5 specimens, well chitinized, bearing Polyzoa; several smaller, very soft specimens.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m.; gn. M. St. Large otter trawl: 12 specimens, several soft.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m.; gn. M. S. Large otter trawl: many specimens, adult and immature.

St. 159. 21. i. 27. 53° 52′ 30″ S, 36° 08′ W, 160 m.; R. Large dredge: 4 specimens.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m.; R. Large dredge: many specimens, all very setose, including ovigerous and larvigerous ♂♂.

St. 172. 26. ii. 27. Off Deception Island, South Shetlands, 525 m.; R. Large dredge: 2 specimens with *N. bouvieri*, n.sp.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 63° 17′ 20″ S, 59° 48′ 15″ W, 200 m.; M. St. G. Large dredge: 1 specimen.

St. 180. 2. iii. 27. 1·7 miles W of N point of Gand Island, Schollaert Channel, Palmer Archipelago, 160–330 m.; M. St. Large otter trawl: several specimens with *Colossendeis frigida*, *N. brevicaudatum* and *Pallenopsis pilosa*.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m.; M. Large otter trawl: numerous specimens.

St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m.; M. Large otter trawl: several specimens; 1 ♂ with whole dorsal surface covered by an encrusting Polyzoon.

St. 186. 16. iii. 27. Fournier Bay, Anvers Island, Palmer Archipelago, 295 m.; M. Large dredge: 6 specimens.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259 m.; M. Large dredge: numerous specimens, the majority with body and legs banded with dark brown.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Georgia, 391 m.; M. St. Large dredge: 2 specimens with *N. charcoti* and *N. biarticulatum*.

St. 366. 6. iii. 30. 4 cables S of Cook Island, South Sandwich Islands, 155–322 m. Large dredge: many specimens, including ♂♂ carrying eggs and advanced larvae.

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 1 ♀, 1 immature specimen.

St. 456. 18. x. 30. 1 mile E of Bouvet Island, 40–45 m. Large dredge: 1 ♀.

St. 458. 19. x. 30. 7 miles S 50° W of Cape Circumcision, Bouvet Island, 357–377 m. Large dredge: many specimens including larvigerous ♂♂.

DESCRIPTION OF MALE.[1] *Trunk*, as a rule, compact; lateral processes separated by a distance varying from one-fourth of, to equality with, their own diameter. Neck short, as a rule, but longer in some specimens than in others; cephalic segment nearly as wide anteriorly as long; base of oviger in contact with first lateral process. Ocular tubercle high (2·5–3 times as high as wide), eyes sub-terminal. A few setae on each lateral process and cephalic lobe.

Proboscis sub-cylindrical, approximately equal to cephalic segment and three-fourths of scape.

Abdomen reaching to distal articulation of first coxa, pyriform, bearing a few slender setae.

Chelophore. Scape 4·5 times as long as wide distally, setose (Bouvier, 1913, p. 76, fig. 27). Fingers longer than palm, each armed with 38–46 crowded spinules; setose pad small, on proximal third of immovable finger.

Palp. For proportions of segments 2–5 see Table VI and Fig. 25 *d*.

Oviger as represented in Fig. 26 *b*; terminal claw three-fourths of tenth segment, armed with 7–9 spinules. Total number of denticulate spines 23–37. Segments 4–6 in the proportions 1·36 : 2 : 1; segment 5 much inflated in distal half and the thin walled portion (*x*) is often collapsed in fixed material; segment 6 also swollen and thin walled, often caved in at *x*.

Third leg rather short and setose. Second coxa slightly longer than the sum of the first and third. Femur shorter than either tibia; numerous (16–18) small, obscure gland

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[1] This species has been described at considerable length by various authors (see synonymy); but a very brief description of the male is given here for the sake of uniformity.

openings on proximal two-thirds of mid-ventral surface. First tibia the longest segment. Tarsus and propodus both elongated, the former considerably longer than the latter. Claw approximately half as long as propodus, auxiliaries vestigial.

The *female* has the oviger of the normal female type; the femur is rather swollen ventrally except in the distal third, the length being 3·5–4·5 times the maximum width.

REMARKS. A re-examination of Hodgson's type specimens of *N. assimile* left no doubt as to their identity with *N. australe*.

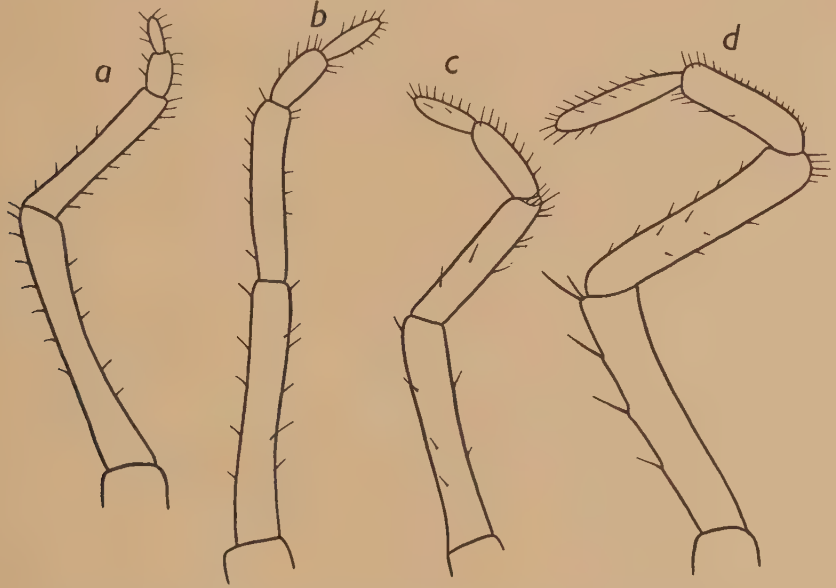

Fig. 25. Palp of: *a. Nymphon bouvieri*, n.sp. *b. N. brevicaudatum*, Miers. *c. N. neumayri*, n.sp. *d. N. australe*, Hodgson. (All × 27.)

The Discovery specimens from St. 170 agree with the co-types of *N. australe*; the lateral processes are but little separated, the legs are relatively stout and bear numerous long setae. The majority of the specimens, however, have the legs more slender and less setose, the body less compact, and thus agree more closely with *N. australe* var. *austrinorum*, Hodgson. Many of the specimens, especially those from St. WS 32 to St. 144 (in the list of stations) are even less setose than the *austrinorum* forms.

Loman (1923, p. 13) has emphasized the importance of the number of denticulate spines on the four terminal segments of the oviger in the genus *Nymphon*. In nine co-types of *N. australe* examined the total number of denticulate spines varied from twenty-three to thirty, and in six co-types of *N. australe* var. *austrinorum*[1] from thirty to thirty-seven. The greater number in the variety is probably due to the fact that the specimens are of considerably larger size than the typical forms. At any rate, the number varied from twenty-eight to thirty-four in all samples of the Discovery material

[1] Hodgson (1907, p. 35) states that in *N. australe* var. *austrinorum* the "tarsus and propodus together are distinctly shorter than the femur" and equal to it in typical specimens; but in the co-types measured, tarsus and propodus together are nearly equal to the femur in *N. australe* as well as in the variety *austrinorum*.

where the *austrinorum* forms are smaller, and the typical specimens (St. 170) somewhat larger, than Hodgson's co-types.

Table VI

Name of species in group II	Relative proportions* of palpal segments 2–5				Total length of segments 4 + 5
	2	3	4	5	
N. capense	10 :	9·00 :	6·00 :	5·00	11·00
N. compactum	10	9·70	6·08	5·80	11·88
N. compactum	10	9·10	5·46	5·46	10·92
N. australe, co-type	10	9·20	5·60	4·80	10·40
N. australe, co-type	10	9·30	5·56	4·44	10·00
N. australe, St. 172	10	7·00	5·00	4·50	9·50
N. australe var. *austrinorum* co-types	10	8·60	6·00	5·70	11·70
	10	8·20	5·30	4·70	10·00
N. orcadense, co-type	10	8·00	4·80	4·80	9·60
N. orcadense, co-type	10	7·90	5·40	5·20	10·60
N. articulare	10	6·25	3·75	4·05	7·80
N. neumayri, holotype	10	7·80	4·80	3·00	7·80
N. neumayri, paratype	10	6·66	4·10	3·33	7·43
N. villosum, holotype	10	7·30	3·00	3·70	6·70
N. brevicaudatum, paratype	10	6·10	2·12	2·27	4·39
N. brevicaudatum, St. WS 42	10	6·66	2·00	2·00	4·00
N. brevicaudatum, St. 159	10	6·10	2·61	2·82	5·43
N. biarticulatum, holotype	10	7·25	2·00	2·25	4·25
N. biarticulatum, St. 182	10	7·40	2·22	2·22	4·44
N. biarticulatum, St. 190	10	6·66	2·00	2·20	4·20
N. proximum, holotype	10	6·66	2·11	2·11	4·22
N. mendosum, holotype	10	6·10	2·17	1·74	3·91
N. mendosum, co-type	10	5·60	2·00	1·50	3·50
N. mendosum, T.N. 340†	10	6·00	2·22	2·20	4·20
N. ? biarticulatum, St. 167	10	6·86	1·86	1·71	3·57
N. ? biarticulatum	10	8·86	1·77	1·77	3·54
N. ? biarticulatum	10	6·66	1·83	1·50	3·33
N. bouvieri, paratype	10	5·5	1·82	0·91	2·73
N. bouvieri	10	6·40	1·82	1·00	2·82
N. bouvieri	10	6·00	1·60	1·00	2·60

* In order the more readily to compare these proportions, the length of the second segment is regarded as = 10.

† T.N. = Terra Nova collection.

N. australe differs from the majority of the species in group II in two respects: (1) the auxiliary claws are vestigial, and (2) the oviger in the male shows a considerable departure from the norm, certain portions being much inflated and thin walled (cf. Fig. 26 *b* with Figs. 26 *a* and *c*, and 27). Two other Antarctic species, not represented in the Discovery collection, were also found to have certain segments inflated—viz. *N. capense*, Hodgson, and *N. compactum*, Hoek (see Gordon, 1932, pp. 115–120). In both these species the auxiliaries are absent. The inflated condition is least developed in *N. compactum* and most pronounced in *N. australe*. In all three species segment 5 is relatively short and stout so that they may be regarded as aberrant members of group II. *N. australe* shows affinities with *N. orcadense* (see Table III), for the palp and chela are very similar in both and there is approximately the same number of denticulate spines on the oviger.

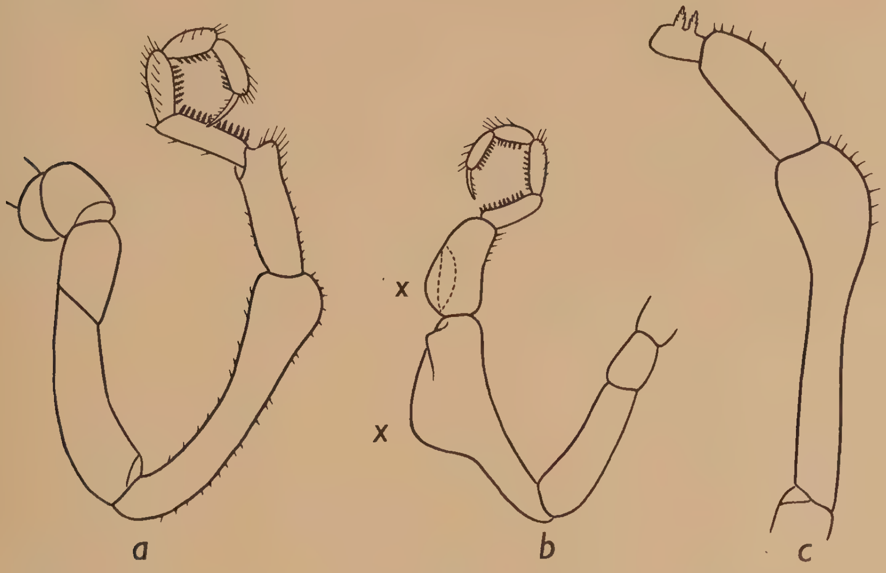

Fig. 26. Male oviger of: *a. Nymphon orcadense*, Hodgson: ×17. *b. N. australe*, Hodgson: ×17. Type II *a*; segments 5 and 6 thin-walled and inflated at *x*. *c.* Segments 5–7 of male oviger of *N. brevicaudatum*, Miers: ×27.

DISTRIBUTION. Circumpolar; this is the first record of the typical *australe* form from the western side of the Antarctic (cf. Loman, 1923, p. 21).

Nymphon orcadense, Hodgson (Fig. 26 *a*).

Chaetonymphon orcadense, Hodgson, 1908, p. 173, pl. ii, figs. 2, 2 *a*.
Chaetonymphon orcadense, Loman, 1923, p. 22.
Nymphon orcadense, Calman, 1920, p. 246.

St. 163. 17. ii. 27. Paul Harbour, Signy Island, South Orkneys, 18–27 m. Small beam trawl: 18 specimens, including ovigerous ♂♂, several with encrusting Polyzoa.

St. 164. 18. ii. 27. E end of Normanna Strait, South Orkneys, near Cape Hansen, Coronation Island, 24–36 m. Small beam trawl: many specimens both adult and immature; several with encrusting Polyzoa.

DESCRIPTION OF MALE. *Trunk* compact, lateral processes in contact proximally or separated by very narrow intervals. Neck short; oviger base, as usual in the short-necked forms, occupying the gap between anterior cephalic lobe and first lateral process. Anterior width of cephalon seven-eighths of length. Height of ocular tubercle nearly twice the width, which increases somewhat towards the apex where the eyes are situated. A few setae near the distal articulation of each lateral process and on each anterior cephalic lobe.

Proboscis equal to cephalic segment and a little shorter than scape, greatly expanded in the middle.

Abdomen rather short, reaching to middle of first coxa; bifid; not elevated.

Chelophore. Scape, which bears several long and numerous short, fine setae, nearly four times as long as wide distally. Fingers of chela slightly longer than palm, each armed with 35–45 spinules according to the size of the specimen; setose pad extending half-way along immovable finger.

Palp. Two terminal segments together approximately equal to, and third four-fifths of, second segment (Table VI).

Oviger. Terminal claw half as long as tenth segment, armed with 10–13 spinules; total number of denticulate spines 30–36. Segments 4–6 in the proportions 1·68 : 2·22 : 1, segment 5 short, rather curved and distinctly clubbed distally. The termino-lateral articulation of the seventh on the sixth segment is characteristic of this species (Fig. 26 *a*).

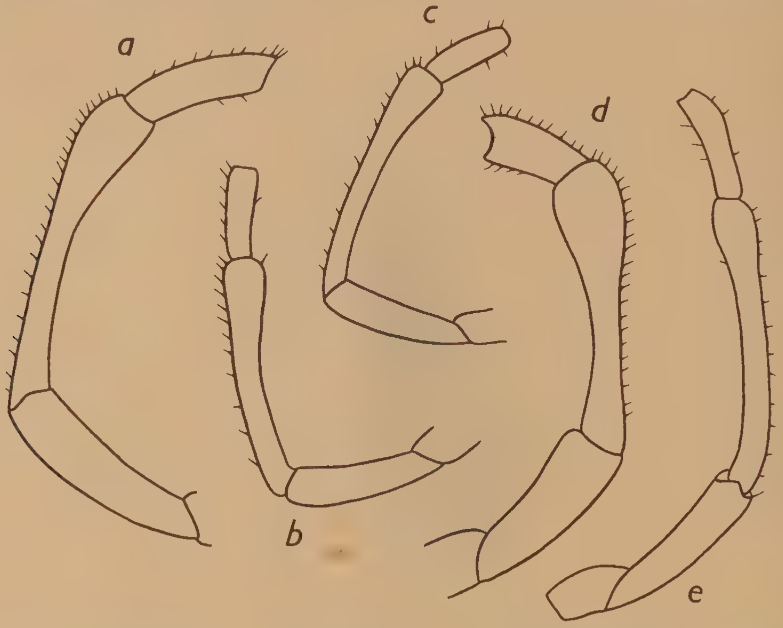

Fig. 27. Segments 4–6 of male oviger of: *a. Nymphon proximum*, Calman. *b. N. bouvieri*, n.sp. *c. N. mendosum*, Hodgson. *d. N. biarticulatum*, Hodgson. *e. N. neumayri*, n.sp. (Type II—all × 20.)

Third leg. Second coxa a little longer, dorsally, than the sum of the other two. Femur shorter than either tibia, at least thirty crowded, small gland openings along mid-ventral surface; second tibia slightly longer than first. Tarsus and propodus both elongated and armed ventrally with numerous fine setae; the former always slightly longer than the latter (1·05–1·31 : 1). Claw nearly half as long as propodus as a rule; auxiliaries from one-fourth to one-third of main claw.

The legs are robust and setose; in addition to the fine, short setae, there are long setae at the distal articulation of (1) the third coxa—ventrally; (2) the femur—dorsally; (3) each tibia—ventrally; and a number of strong setae along the lateral margins of the latter.

The female does not differ markedly from the male. The legs, especially as regards the femur, are more robust and less setose. The oviger is of the usual type with the seventh normally articulated to the sixth segment.

REMARKS. The specimens in the Discovery collection agree well with the co-types from Scotia Bay.

This species undoubtedly belongs to group II and yet it has (1) a rather shorter abdomen, (2) a longer second tibia, (3) more numerous spinules[1] on the fingers of the chela, and (4) a higher number of denticulate spines on the oviger than any of the other typical species (see Table III). In all these respects it approaches *N. clarenci*, n.sp., and *N. brachyrhynchum*, Hoek, especially the former in which the palp is of the same type. Also the atypical[2] species in group II are more closely allied to *N. orcadense* than to any of the other typical species.

DISTRIBUTION. Previously recorded from Scotia Bay; Burdwood Bank, south of Falkland Islands and South Georgia.

Nymphon articulare, Hodgson (Figs. 23 *a*, 28 and 29 *a*, *b*).

Hodgson, 1908, pp. 170–172, pl. i, figs. 4, 4 *a*.
Bouvier, 1913, p. 72 (in key).
Loman, 1923, p. 13 (in table).

St. 164. 18. ii. 27. E end of Normanna Strait, South Orkneys, near Cape Hansen, Coronation Island, 24–36 m. Small beam trawl: 1 ♀, 1 ♂ and several immature specimens.

DESCRIPTION OF MALE TOPOTYPE.[3] *Trunk* non-setose, rather compact; lateral processes separated by half of their own diameter or rather more. Neck very short, the posterior two-thirds on either side occupied by the base of the oviger; cephalic segment almost as wide anteriorly as long. Ocular tubercle high and rather wide; eyes small and set near to the bifid apex.

Proboscis a little shorter than scape and equal to cephalic segment; stout, subcylindrical, contracted somewhat at base.

Abdomen pyriform, reaching to distal end of first coxa; elevated at an angle of about 10°.

Chelophore. Scape rather longer than chela, with a few long, fine setae along the dorsal surface; length 4·5 times the greatest width. Chela as represented in Fig. 28, fingers rather longer than palm and each armed with short, irregular, often recurved, spinules. The number of spinules varies from eighteen to twenty-five in the five co-types, and there are 2–6 more on the movable than on the immovable finger. Setose pad extending half-way along the latter.

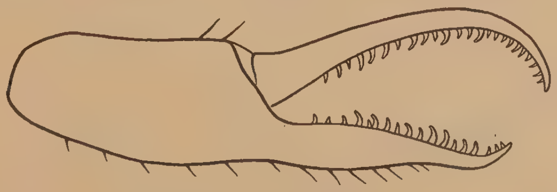

Fig. 28. *Nymphon articulare*, Hodgson. Chela of co-type: × 47. The palm may not be quite accurate as proximal part was damaged on slide.

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[1] *N. brevicaudatum* and *N. biarticulatum* have approximately the same number as *N. orcadense*.
[2] Especially *N. australe*, see p. 62; and also Table VI.
[3] Hodgson apparently did not examine this specimen, see p. 66.

Palpal segments 2–5 in the proportions 4 : 2·5 : 1·5 : 1·62.

Oviger. Terminal claw half as long as tenth segment, armed with 7–10 small spinules. Total number of denticulate spines 25 (7 + 6 + 5 + 7). Segments 4–6 in the proportions 1·85 : 2·54 : 1; segment 5 short and clubbed distally (Fig. 24 *a*).

Third leg rather slender and setose; a number of long, fine setae on the coxae and at the distal end of the femur (maximum length equal to the diameter of the segment); those on the distal segments sparse and very short. Coxae short and stout, dorsal length of second equal to the sum of the first and third. Femur subequal to second, first tibia the longest segment. Tarsus and propodus both elongated, the former nine-tenths of the latter. Claw not quite half as long as propodus; auxiliaries well developed, one-third of main claw.

Measurements (*mm.*)

	♂	♀
Length of proboscis	1·08	1·12
Diameter of proboscis	0·56	0·6
Length of trunk	2·4	2·6
Length of cephalic segment	1·06	1·12
Width of cephalon	0·96	1·0
Width of neck	0·56	0·48
Width across second lateral processes	2·0	2·0
Length of abdomen	0·88	0·84
Length of scape	1·32	1·48
Third leg:		
First coxa	0·6	0·6
Second coxa	0·9	0·8
Third coxa	0·3	0·25
Femur	1·8	1·8
First tibia	2·1	2·08
Second tibia	1·9	1·75
Tarsus	0·9	0·9
Propodus	1·05	1·0
Claw	0·44	0·48
Auxiliaries	0·16	0·16

The *female* is characterized by having the femur much enlarged in the proximal two-thirds. The length is only 2·5 times the maximum width as against 4·5 times in the male (Fig. 29 *a* and *b*).

Remarks. Hodgson (1908, p. 172) mentions only three adult females in his description, but five specimens, including one male and all undoubtedly belonging to this species, were obtained on loan from the Royal Scottish Museum, Edinburgh. Hodgson apparently did not have two of these specimens and referred the species to the genus "*Nymphon*", while in reality it belongs to the "*Chaetonymphon*" group as is shown by the form of the male oviger (Fig. 23 *a*). *N. neumayri*, n.sp., is closely related to *N. articulare*; the most outstanding differences between the two are listed on p. 69.

Distribution. South Orkneys.

Nymphon neumayri, n.sp. (Figs. 27 *e*, 29 *c–e* and 30).

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W, 259 m.; M. Large dredge: 3 ♂♂, 3 ♀♀ and 3 immature specimens, with *N. australe*.

Description of holotype (♂). *Trunk* compact, last two pairs of lateral processes in contact proximally, the others separated by very short intervals. Cephalic segment as wide anteriorly as long; neck very short, base of oviger occupying most of the space between anterior cephalic lobe and first lateral process. Ocular tubercle high (0·8 mm.), very wide at base (0·6 mm.), tapering to about half that width at the apex on which the four eyes are set. Setae almost entirely absent (Fig. 30).

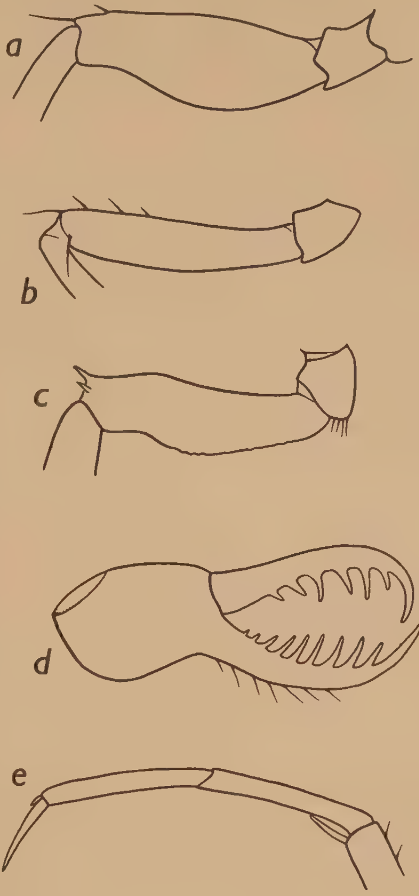

Fig. 29. *Nymphon articulare*, Hodgson: *a*. Femur of third leg of female. *b*. Same of male. *Nymphon neumayri*, n.sp.: *c*. Femur of male. *d*. Chela. *e*. Terminal segments of third leg. (*a–c*: × 20; *d* and *e*: × 27.)

Proboscis stout, sub-cylindrical, rounded at apex, somewhat contracted at base; slightly shorter than either scape or cephalic segment.

Abdomen horizontal, fusiform, reaching to middle of second coxa.

Scape of *chelophore* nearly four times as long as wide, with a few very minute setae at the distal end. Chela shorter than scape (see measurements), palm short, ovoid, fingers half as long again as palm, much curved, each armed with seven or eight long spinules; a few fine setae on proximal half of immovable finger (Fig. 29 *d*).

Palp with two terminal segments together approximately equal to third, and three-fourths of second segment (segments 2–5 in the proportions 10:7·7:4·4:3·2 and in female as 10:7·8:4·8:3).

Oviger. Terminal claw subequal to tenth segment and armed with 4–5 spinules. Total number of denticulate spines, 26.[1] Segments 4–6 as represented in Fig. 27 *e*, and in the proportions 1·82 : 2·55 : 1.

Third leg rather stout proximally, and tapering gradually from the distal articulation of the first tibia where the width is suddenly reduced to almost one-half (i.e. proximal width of second is less than two-thirds distal width of first tibia, see Fig. 30 *c*, ♀). Second coxa equal to the sum of the other two (dorsal measurements). Femur shorter than either tibia, three times as long as wide and slightly inflated ventrally (Fig. 29 *c*); no raised femoral gland tubercles are present and, indeed, no trace of gland openings has been observed. First tibia the longest segment. Tarsus subequal to propodus; claw approximately half the length of the latter; auxiliary claws very short, about one-fifth of claw.

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[1] The number varies from 22–27 in adults and the following are typical formulae 6 + 6 + 4 + 6; 7 + 7 + 5 + 7; 8 + 6 + 5 + 7; 8 + 7 + 5 + 7; in an immature specimen 3 + 4 + 2 + 5.

Setae are small and few in number; there are 4–6 spinose setae near the distal articulation of the femur (Fig. 29 *c*) and a large spine, on the mid-ventral line, at the distal end of the second tibia (Fig. 29 *e*).

The *female* shows the usual sexual differences of oviger and legs; the femur (Fig. 30 *c*) is much enlarged throughout three-fourths of its length; the genital pores are very conspicuous.

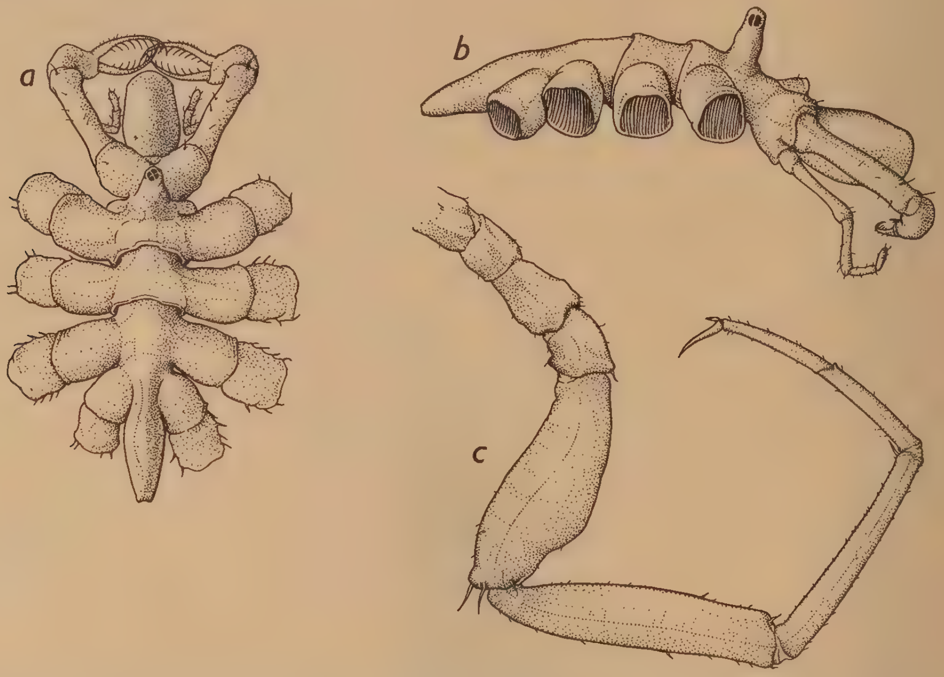

Fig. 30. *Nymphon neumayri*, n.sp.: *a*. Holotype. Dorsal view of body with chelophores and palps. *b*. Holotype. Lateral view of body, with chelophore and palp. *c*. Third leg of female.

Measurements (mm.)

	Holotype	♀
Length of proboscis	1·4	1·8
Diameter of proboscis	1·0	0·9
Length of trunk	4·0	4·4
Length of cephalic segment	1·8	2·0
Width of cephalic lobes	1·8	2·3
Width across second lateral processes	3·3	3·4
Length of abdomen	2·1	2·0
Length of scape	2·2	2·2
Length of chela	1·6	1·6
Third right leg:		
First coxa	0·8	0·8
Second coxa	1·2	1·2
Third coxa	0·4	0·4
Femur	3·01	3·2
First tibia	4·2	4·4
Second tibia	3·6	3·8
Tarsus	1·8	1·9
Propodus	1·75	1·8
Claw	0·8	0·9

REMARKS. This species is much less setose than is typical of the short-necked, compactly built forms, there being no long setae on the body and very few on the legs. The chela differs from that of all the allied forms; it recalls that of *N. proceroides*, Bouvier (cf. Figs. 29 *d* and 9), but the fingers are much curved and the spinules are longer and fewer in number.

N. neumayri is most closely allied to *N. articulare*, Hodgson, which also has the femur in the female much enlarged throughout part of its length (Fig. 29 *a*). But it may be readily distinguished from the latter by (1) its larger size and more compact build, (2) the widely gaping fingers of the chela each armed with 6–9 instead of 18–25 spinules, and (3) the marked difference in the outline of the femur in the male (cf. Fig. 29 *b* and *c*).

Nymphon brevicaudatum, Miers (Figs. 25 *b*, 26 *c* and 31 *b*, *d*).

N. brevicaudatum, Miers, 1875, p. 117.
N. brevicaudatum, Miers, 1879, p. 212, pl. xi, fig. 8.
Chaetonymphon brevicaudatum, Möbius, 1902, p. 181, pl. xxv, fig. 9.
Ch. brevicaudatum, Loman, 1923, p. 21.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m.; M. R. Large dredge: 3 adult and 4 immature specimens.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m.; gy. M. Large otter trawl: 12 specimens.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m.; M. Large otter trawl: many specimens, one carrying a Brachiopod.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 230–250 m.; gy. M. Large otter trawl: 12 specimens, 1 carrying a sponge.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m.; gn. M. St. Large otter trawl: many specimens.

St. 141. 29. xii. 26. East Cumberland Bay, South Georgia, 200 yards from shore, under Mount Duse, 17–27 m.; M. Small beam trawl: many specimens, several of the ♂♂ carrying eggs or larvae, two stages on one specimen.

St. 143. 30. xii. 26. Off mouth of East Cumberland Bay, South Georgia, 273 m.; M. Large otter trawl: 1 larvigerous ♂.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m.; gn. M. S. Large otter trawl: several specimens.

St. 145. 7. i. 27. Stromness Harbour, South Georgia, between Grass Island and Tonsberg Point, 26–35 m. Small beam trawl: several specimens.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m.; gy. M. St. Large otter trawl: a dozen specimens, several ovigerous ♂♂.

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, 200–234 m.; M. Large otter trawl: 2 specimens.

St. 156. 20. i. 27. 53° 51′ S, 36° 21′ 30″ W, 200–236 m.; R. Large dredge: 5 specimens.

St. 159. 21. i. 27. 53° 52′ 30″ S, 36° 08′ W, 160 m.; R. Large dredge: many specimens.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m.; R. Large dredge: 3 specimens.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 63° 17′ 20″ S, 59° 48′ 15″ W, 200 m.; M. St. G. Large dredge: 2 specimens with *N. australe*.

St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 1080 m.; M. cS. St. Large dredge: 2 specimens.

South Georgia:

St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, 130 m.; gy. M. St. 1 m. horizontal tow-net: 1 specimen.

St. WS 42. 7. i. 27. 54° 41′ 45″ S, 36° 47′ W, 198 m.; bottom. 1 m. horizontal tow-net: 1 specimen.

St. MS 10. 14. ii. 25. East Cumberland Bay. ¼ mile SE of Hope Point to ¼ mile S of Government Flagstaff, 18–26 m. Small beam trawl: 6 specimens.

St. MS 12. 17. ii. 25. East Cumberland Bay. 1 cable E to 1 mile S × E ½ E of Hobart Rock, 25–60 m. Small beam trawl: 1 specimen.

St. MS 25. 13. iv. 25. East Cumberland Bay. 4½ cables NE to 1¼ cables N × W of Hobart Rock, 36 m. Small beam trawl: 2 specimens.

St. MS 33. 1. v. 25. 1 cable E of Hobart Rock, East Cumberland Bay, 40 m. Small beam trawl: 1 specimen.

St. MS 63. 24. ii. 26. East Cumberland Bay. 1·3 miles S × E to 1·6 miles SE × S of Hope Point, 23 m. Small beam trawl: 3 specimens.

REDESCRIPTION OF HOLOTYPE (ovigerous ♂).[1] *Trunk* compact; lateral processes separated by less than half their own diameter, last two pairs in contact proximally. Neck short but distinct; space between anterior cephalic lobes and first lateral process entirely occupied by the oviger base; anterior width of cephalon five-sixths of the length. Ocular tubercle of medium height, cylindrical and rather stout; eyes sub-terminal.

There are 4–6 long, and a few shorter, setae on the mid-dorsal surface of segments 1, 2 and 3 respectively, and two long setae on each cephalic lobe.[2] The lateral processes each bear a number of setae of which 2–4 near the distal articulation are longest.

Proboscis short, stout, sub-cylindrical, rounded at apex; subequal to cephalic segment and considerably shorter than scape.

Abdomen horizontal, reaching a short distance beyond first coxa; sub-cylindrical, tapering distally; three setae, of which the median is longest, at base and a few tiny setae on the distal half.

Chelophore rather similar to that of *N. biarticulatum*, Miers. Scape setose;[3] length nearly four times the distal width. Fingers equal to palm, each armed with twenty-nine and thirty-five crowded spinules of unequal lengths.

Palp rather slender; proportions of segments 2–5 as represented in Fig. 26 *b* (see also Table V).

Oviger. Terminal claw subequal to tenth segment, armed with five spinules. Total number of denticulate spines eleven (see Table III). Segments 4–6 in the proportions 1·35 : 2·3 : 1; segment 5 clubbed distally (Fig. 27 *c*).

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[1] The most complete of the type specimens has been selected as holotype; B.M. collection.

[2] Three or four in all the paratypes.

[3] 3–4 long setae longitudinally on the mid-dorsal surface; a few finer, shorter setae on proximal half of outer margin; a semicircle of setae, increasing gradually in length towards the inner edge, near the distal articulation.

Third leg relatively short and setose; the length of the setae on each tibia and at the distal end of femur is equal to the diameter of the segment. Second coxa as long as the sum of the first and third (dorsal measurements). Three or four high wide gland tubercles on mid-ventral surface of femur, which is equal to second tibia; first tibia the longest segment (see Table III). Tarsus shorter than propodus; claw less than half as long as the latter; auxiliaries well developed, one-third of main claw.

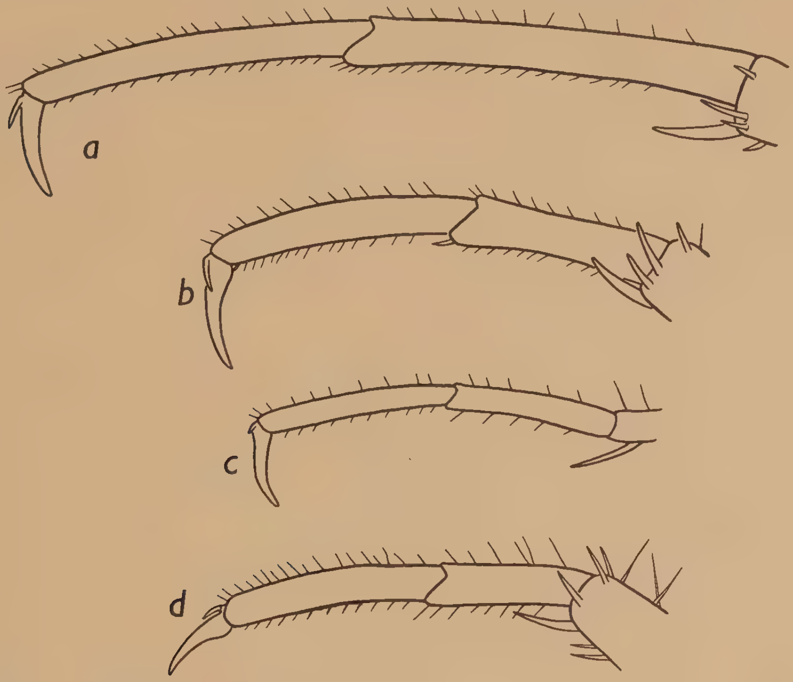

Fig. 31. Terminal segments of third leg of:
Nymphon biarticulatum, Hodgson: *a*, adult; *c*, young from St. 181 (length = 4 mm.).
N. brevicaudatum, Miers: *b*, adult co-type; *d*, young from St. 42 (length = 4 mm.).

Remarks. The majority of the specimens in the Discovery collection come from the neighbourhood of South Georgia. A few specimens were collected off Clarence Island and the South Shetlands, but none from Palmer Archipelago, where the bulk of the specimens referred to *N. biarticulatum*, Hodgson, occurred. *N. brevicaudatum* and *N. biarticulatum* are very closely allied and the latter may prove to be a more southern variety of the former (see p. 72).

Distribution. Kerguelen, South Georgia and South Shetlands.

Nymphon biarticulatum, Hodgson (Figs. 27 *d*, 31 *a*, *c* and 32 *a*).

Chaetonymphon biarticulatum, Hodgson, 1907, p. 28, pl. iv, fig. 2; pl. x, fig. 12.

St. 167. 20. ii. 27. Off Signy Island, South Orkneys, 244–344 m.; gn. M. Large otter trawl: 6 specimens.

St. 180. 11. iii. 27. 1·7 miles W of N point of Gand Island, Schollaert Channel, Palmer Archipelago, 160 m.; M. St. Large dredge: 3 ♂ specimens.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m.; M. Large otter trawl: 20 specimens.

St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m.; M. Large otter trawl: several specimens.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 315 m.; M. R. Large dredge: 4 specimens (1 immature).

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 391 m.; M. St. 2 adult and 2 immature specimens with *Nymphon charcoti* and *N. australe*.

REDESCRIPTION OF HOLOTYPE (♀). *Trunk* compact; lateral processes separated by approximately half their own diameter, last two pairs almost in contact proximally. Neck short; base of oviger occupies the entire space between first lateral process and anterior cephalic lobe. Ocular tubercle three times as high as wide; eyes small, situated near the apex. There is a pair of long setae[1] on the mid-dorsal surface of segments 1–3 and on each cephalic lobe.

Proboscis slightly longer than cephalic segment, a little shorter than scape; stout and sub-cylindrical.

Abdomen reaching to middle of second coxa; wide in middle and tapering abruptly towards the apex; setae very minute. Not elevated.

Chelophore. Scape setose, length 4·5 times the distal width. Palm long and narrow, equal to movable finger which is armed with 40–42 spinules; immovable finger with 30–33 spinules and a setose pad on the proximal half (Fig. 32 *a*).

Palp very similar to that of *N. brevicaudatum*, Miers (for proportions of segments 2–5 see Table V).

Oviger. Terminal claw slightly longer than tenth segment, armed with eight long spinules. Total number of denticulate spines 18 (6 + 5 + 3 + 4). Segments 4–6 rather long, in the proportions 1·43 : 1·71 : 1 (Fig. 27 *d*).

Third leg. Second coxa equal to the sum of the other two (dorsal measurements). Femur robust, 3·5 times as long as wide; first tibia the longest segment (Table III). As in *N. brevicaudatum* there are long setae on the legs, especially on the three principal segments.

Tarsus and propodus slender, elongated, the former exceeding the latter in length (Fig. 31 *a*). Claw approximately one-third of propodus, auxiliaries well developed.

REMARKS. The holotype, which is now rather damaged and broken, is very closely allied to *N. brevicaudatum*, Miers, but the tarsus is longer, not shorter, than the propodus (cf. Fig. 31 *a* and *b*). A number of specimens in the Discovery collection have been referred to *N. biarticulatum*, Hodgson, because the tarsus is consistently longer relative to the propodus than in *N. brevicaudatum*. In adults the tarsus is equal to or longer than, and in immature specimens is only a very little shorter than, the propodus (cf. Fig. 31 *a*, *c* and *b*, *d*). The movable finger of the chela is rather longer than the palm.

This species is very closely related to, and may prove to be only a more southern form of, *N. brevicaudatum*. In addition to the longer tarsus already mentioned, the ocular tubercle is higher, the abdomen is more narrowed posteriorly and the fingers of the chela are rather longer than in *N. brevicaudatum*.

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[1] There are also a number of long setae on each lateral process, but they have been rubbed off.

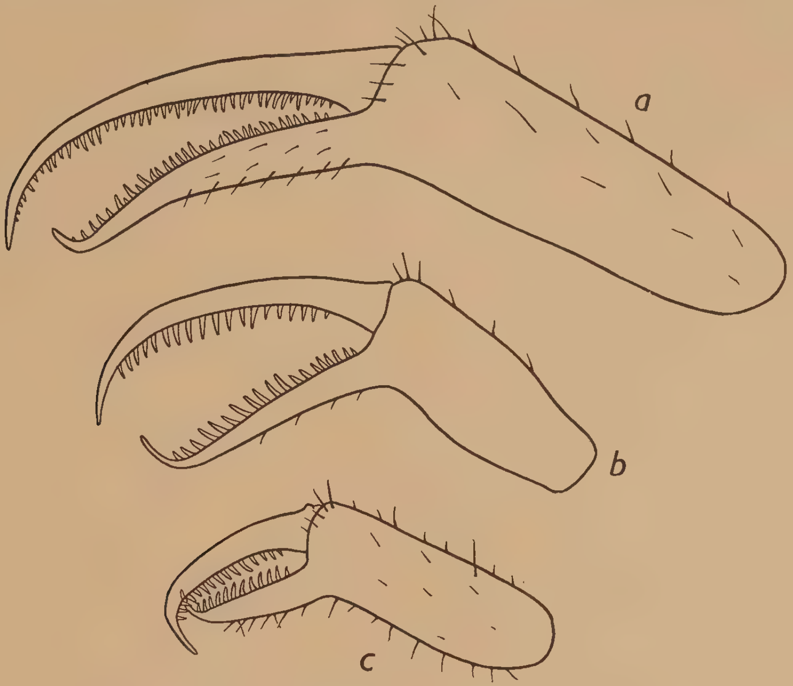

Fig. 32. Chela of: *a*. *Nymphon biarticulatum*, Hodgson, holotype. *b*. *N. mendosum*, Hodgson. *c*. *N. bouvieri*, n.sp. (All × 27.)

The specimens from St. 167 have been provisionally referred to this species. The tarsus is nearly as long as the propodus—i.e. longer than is typical for *N. brevicaudatum*—but the two terminal segments of the palp are consistently shorter than in either species (see Table V).

Distribution. The holotype was collected in the Ross Sea area; with the exception of the specimens from Sts. 167 and 195 this form was collected beyond the southern range for *N. brevicaudatum*.

Nymphon bouvieri, n.sp. (Figs. 25 *a*, 27 *b*, 32 *c* and 33).

St. 172. 26. ii. 27. Off Deception Island, South Shetlands, 525 m.; R. Large dredge: 4 specimens 2 ♂♂ (length of holotype 5·3 mm.) and 2 ♀♀.

Description of holotype (♂). *Trunk* compact (Fig. 32 *a*); lateral processes in contact proximally, each with a few long setae; 2–3 long setae on mid-dorsal surface near the posterior articulation of each segment. Neck very short; cephalic segment almost as wide anteriorly as long. Ocular tubercle high and slender (4–6 times as high as wide); eyes small and sub-terminal.

Proboscis short, two-thirds of cephalic segment and of scape; slightly expanded in middle, rounded at apex.

Abdomen pyriform, reaching to middle of second coxa; not elevated.

Chelophore. Scape equal to cephalic segment, setose (Fig. 33 *a*). Fingers of chela shorter than palm, abruptly bent distally, armed with twelve and fifteen spinules respectively (Fig. 32 *c*).

Palp as represented in Fig. 25 *a*; two terminal segments very short, together less than one-third of second (this is true of all four specimens, see Table V).

Oviger. Terminal claw rather shorter than tenth segment, armed with five spinules. Total number of denticulate spines 15–18. Segments 4–6 in the proportions 1·7 : 2·5 : 1 (Fig. 27 *b*).

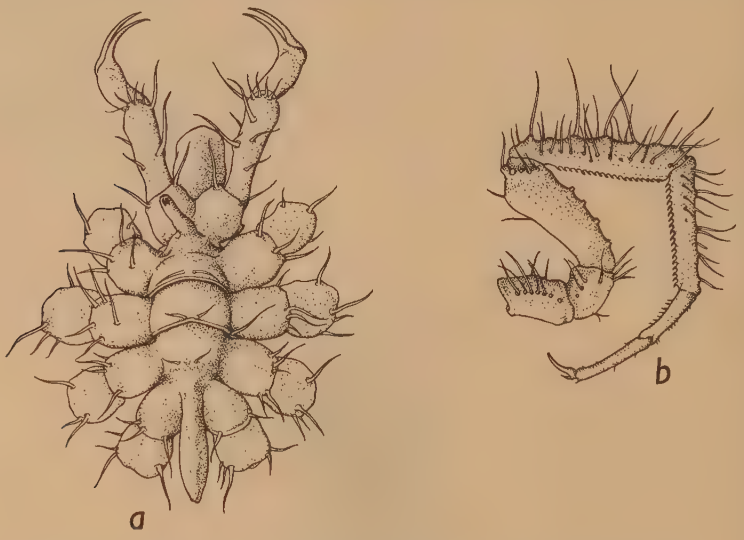

Fig. 33. *Nymphon bouvieri*, n.sp. Holotype: *a*. Dorsal view of body with chelophores: × 12—proboscis foreshortened. *b*. Third leg.

Third leg short and setose (Fig. 33 *b*); setae, as a rule, longer than the diameter of the segment to which they are attached. Second coxa equal to the sum of the other two. Femur subequal to second tibia, with 3–4 high wide gland tubercles on mid-ventral surface. First tibia the longest segment (see measurements). Tarsus approximately two-thirds of propodus; claw nearly half as long as the latter; auxiliaries well developed one-fourth of claw.

Measurements (mm.)

Length of proboscis	1·4
Diameter of proboscis	1·0
Length of trunk	3·6
Width across second lateral processes	3·3
Length of cephalic segment	2·0
Width of cephalic lobes	1·8
Length of abdomen	2·0
Length of scape	2·0

Third leg:

First coxa	0·8
Second coxa	1·2
Third coxa	0·4
Femur	2·2
First tibia	3·25
Second tibia	2·4
Tarsus	1·0
Propodus	1·5
Claw	0·53
Auxiliaries	0·13

The *female* shows the usual sexual differences; the femur is more robust, the length being just over twice the maximum width.

REMARKS. Although it bears a strong superficial resemblance to *N. brevicaudatum*, Miers, this species can readily be distinguished by (1) the extremely short terminal palpal segments, (2) the longer and exceedingly slender ocular tubercle—which is even more slender in the other specimens than in the holotype, and (3) the small number of spinules on the fingers of the chela. In the latter respect it approaches *N. proximum*, Calman (1915, p. 34, fig. 6 D), but the palm is longer and more slender, the fingers more curved distally and the spinules longer; the ocular tubercle is 4–6 times as high as wide instead of only as high as wide; the setae are much longer.

C. SPECIES OF UNCERTAIN SYSTEMATIC POSITION

Nymphon multidens, n.sp. (Figs. 34 and 35).

St. 456. 18. x. 30. 1 mile E of Bouvet Island, 40–45 m. Large dredge: 1 ♀ (holotype).

DESCRIPTION OF HOLOTYPE (♀). *Trunk* rather compact; lateral processes separated by half their own diameter or rather more. Cephalic segment equal to the sum of the three posterior segments; neck rather long, base of oviger in contact with first lateral process. Ocular tubercle as high as wide, rounded; eyes well developed. Setae absent (Fig. 34).

Proboscis short, sub-cylindrical, rounded at apex; much shorter than cephalic segment, and two-thirds of scape.

Abdomen short, sub-cylindrical, reaching to distal end of fourth lateral process; elevated at an angle of about 40°.

Chelophore. Length of scape three times the distal width. Chela somewhat shorter than scape and of a very unusual type (Fig. 35 *d*), with immovable finger very short relative to length of palm. There are twenty-four short, crowded spinules on the movable, 26–28 on the immovable finger; setose pad short but distinct.

Palpal segments 2–5 in the proportions 4 : 3·33 : 1·5 : 2 (Fig. 35 *a*).

Oviger. Terminal claw half of tenth segment, armed with 8–10 short spinules. Total number of denticulate spines at least seventy,[1] but they are so crowded that it is difficult to count the numbers exactly (formula approximately 23 + 16 + 18 + 16 = 73); each spine is long and slender with numerous short, crowded denticulations on each side. Segments 4–6 relatively short, in the proportions 1·8 : 1·75 : 1.

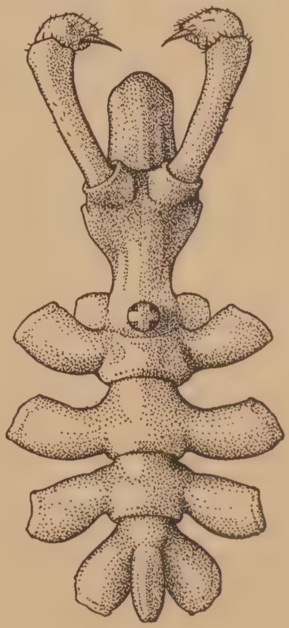

Fig. 34. *Nymphon multidens*, n.sp. Holotype. Dorsal view of body with chelophores: × 16.

Third leg. First coxa very short, second approximately half as long again as the sum of the other two (dorsal measurements). Femur equal to first tibia, not greatly distended

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[1] Hence the specific name.

although containing developing ova (length six times the greatest width). Second tibia the longest segment, half as long again as femur. Tarsus half as long as propodus, ventral margin of each segment armed with numerous short spinose setae; claw short, auxiliaries relatively long (Fig. 35 *c*). Setae for the most part very minute.

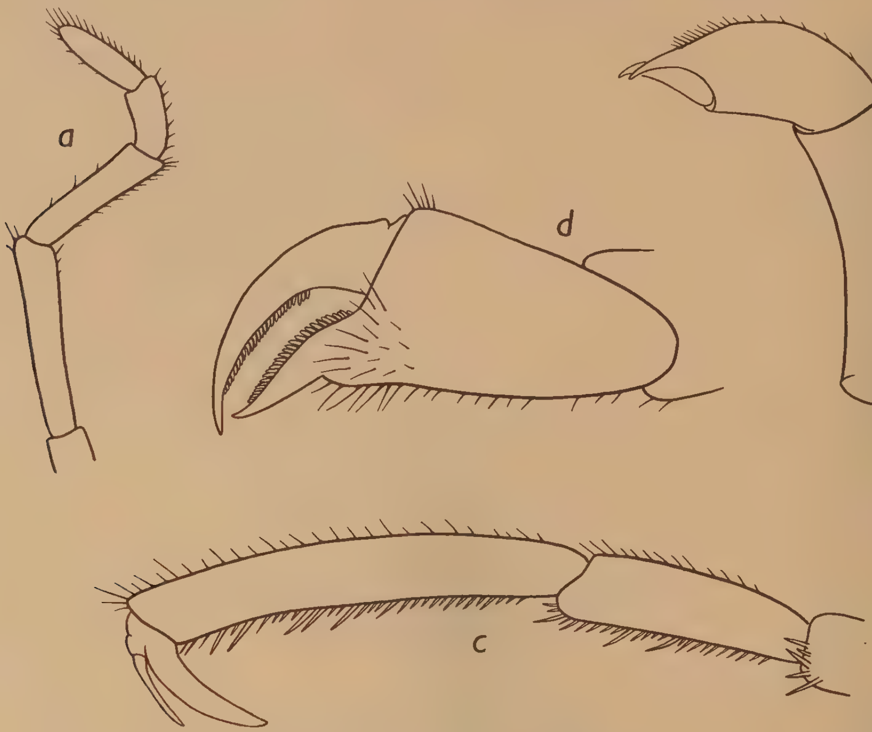

Fig. 35. *Nymphon multidens*, n.sp.: *a*. Palp. *b*. Chelophore. *c*. Terminal segments of third leg. (All × 33.) *d*. Chela: × 60.

Measurements (mm.)

		Third leg:	
Length of proboscis	1·0	First coxa	0·6
Diameter of proboscis	0·6	Second coxa	1·8
Length of trunk	3·4	Third coxa	0·5
Length of cephalic segment	1·7	Femur	4·4
Width of cephalic lobes	0·93	First tibia	4·4
Width of neck	0·5	Second tibia	6·7
Width across second lateral processes	2·3	Tarsus	1·0
Length of abdomen	0·6	Propodus	2·0
		Claw	0·45
		Auxiliaries	0·3

Remarks. This species differs from all other Antarctic and sub-Antarctic species as regards the chela, which recalls that of, e.g., *N. grossipes* (Fabr.) from the North Atlantic (Hoek, 1881, p. 44, pl. iii, figs. 9–12, pl. iv, fig. 1). The northern species, however, has the tarsus elongated and longer than the propodus; there are also three or four very long spines on the proximal ventral margin of the latter and the claw is much longer.

The male is unknown, but the species probably belongs to group I.

Distribution. One mile off the east coast of Bouvet Island.

D. TROPICAL SPECIES

Nymphon angolense, n.sp. (Figs. 36 and 37).

St. 272. 30. vii. 27. Off Elephant Bay, Angola, from 13° 11′ S, 12° 44′ 45″ E to 13° 09′ 45″ S, 12° 46′ E, 73–91 m.; gn. S. M. Large otter trawl: 30 specimens, including ovigerous and larvigerous ♂♂; 2 specimens bear each a small bivalve mollusc.

DESCRIPTION OF HOLOTYPE (larvigerous ♂). *Trunk* elongated and slender, lateral processes separated by more than their own diameter (Fig. 36 *a*). Cephalic segment as long as the remaining segments plus abdomen. Neck long and slender, less than half as wide as the anterior cephalic lobes; base of oviger small and rounded, in contact with first lateral process. Ocular tubercle low and rounded; a little higher than wide, eyes conspicuous (Fig. 36 *a* and *b*).

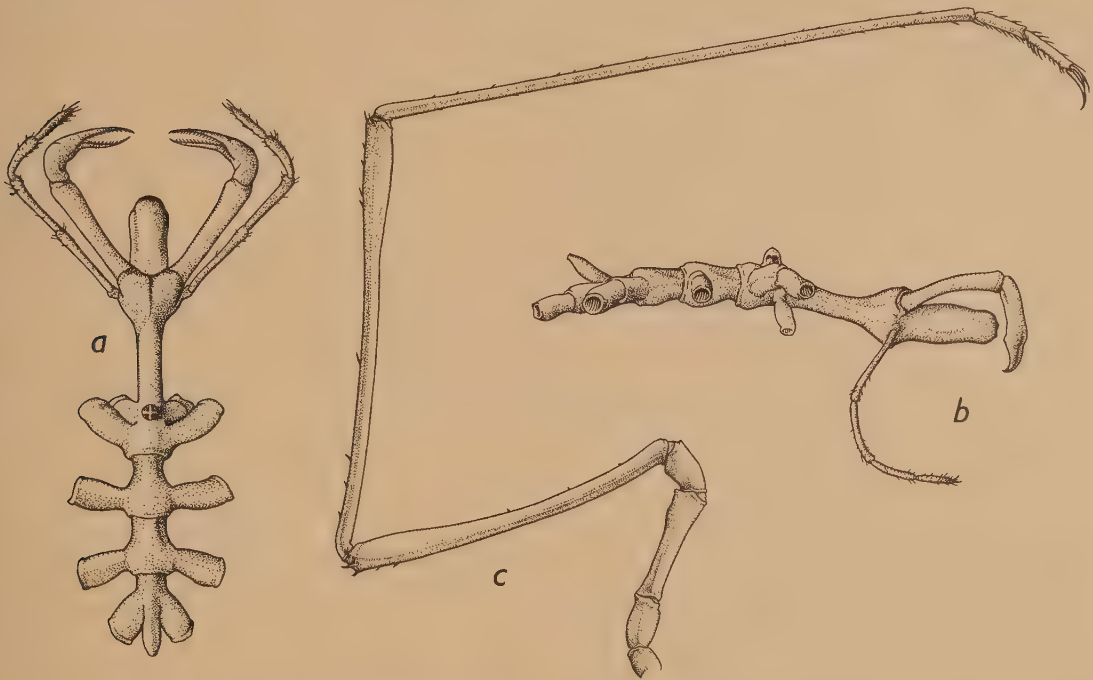

Fig. 36. *Nymphon angolense*, n.sp.: *a*. Dorsal view of body of holotype with chelophores and palps. *b*. Lateral view of body with chelophore and palp. *c*. Third leg.

Proboscis half as long as cephalic segment, cylindrical, rather rounded at apex.

Abdomen reaching a little beyond fourth lateral process, elevated at an angle of about 45°, approximately three times as long as broad.

Chelophore. Scape subequal to proboscis; length five times the distal width. Chela slender, rather curved and somewhat longer than scape (Fig. 37 *a*); fingers a little longer than palm, approximately forty-five crowded spinules on immovable, fifty-five on movable one.

Palp long and slender, segments 2–5 in the proportions 10 : 6 : 3 : 3·3 (Fig. 37 *b*).

Oviger long and slender. Terminal claw two-thirds of tenth segment, armed with fourteen short spinules. Total number of denticulate spines 39 (13 + 10 + 8 + 8). Segments 4–6 as represented in Fig. 37 *d*, in the proportions 2 : 2·3 : 1; segment 5 straight, of almost uniform diameter throughout, with a few hook-like spines near the distal articulation (Fig. 37 *d*).

Third leg long and slender, sparsely beset with short, spinose setae on the three main segments. Second coxa a little longer than the sum of the first and third (dorsal measurements). Femur slender and, like first tibia, expanded in the distal third (Fig. 36 *c*), more than half as long again as the three coxae together; gland openings very inconspicuous, about ten in number. Second tibia the longest segment, approximately five times the sum of tarsus and propodus. The latter slightly longer than the former and armed ventrally with six or seven spines (Fig. 37 *c*). Claw rather more than half as long as propodus; auxiliaries very long—at least two-thirds of claw.

Measurements (mm.)

	Holotype	♀
Length of proboscis	1·8	1·9
Diameter of proboscis	0·7	0·8
Length of trunk	6·0	5·9
Length of cephalic segment	3·6	3·6
Width of cephalic lobes	1·1	1·2
Length of neck	1·6	1·6
Width of neck	0·45	0·5
Width across second lateral processes	2·8	2·8
Length of abdomen	1·0	1·1
Third right leg:		
First coxa	1·0	0·85
Second coxa	2·0	1·6
Third coxa	1·0	0·8
Femur	6·8	7·0
First tibia	9·2	8·4
Second tibia	12·0	12·0
Tarsus	1·1	1·0
Propodus	1·3	1·2
Claw	0·8	0·75
Auxiliaries	0·55	0·5

The *female* is very similar to the male, but segments 4–5 of the oviger are relatively short. The femur is rather more robust and of almost uniform diameter throughout; the first tibia is expanded distally as in the male.

REMARKS. The only species of the genus *Nymphon* previously reported from West Africa is *N. gracillimum*, Calman (Loman, 1923 *b*, p. 5). *N. angolense* differs from the holotype of that species in several respects: (1) there are at least twice as many spinules on the fingers of the chela, (2) there are a few hooked spines near the distal articulation of the fifth segment of the male oviger, (3) the tarsus does not exceed, although it may nearly equal the propodus, (4) the auxiliary claws are more highly developed, and (5) the first tibia in both sexes, and the femur in the male, is expanded distally.

N. angolense does not agree with any of the African species listed by Flynn (1928, p. 6).

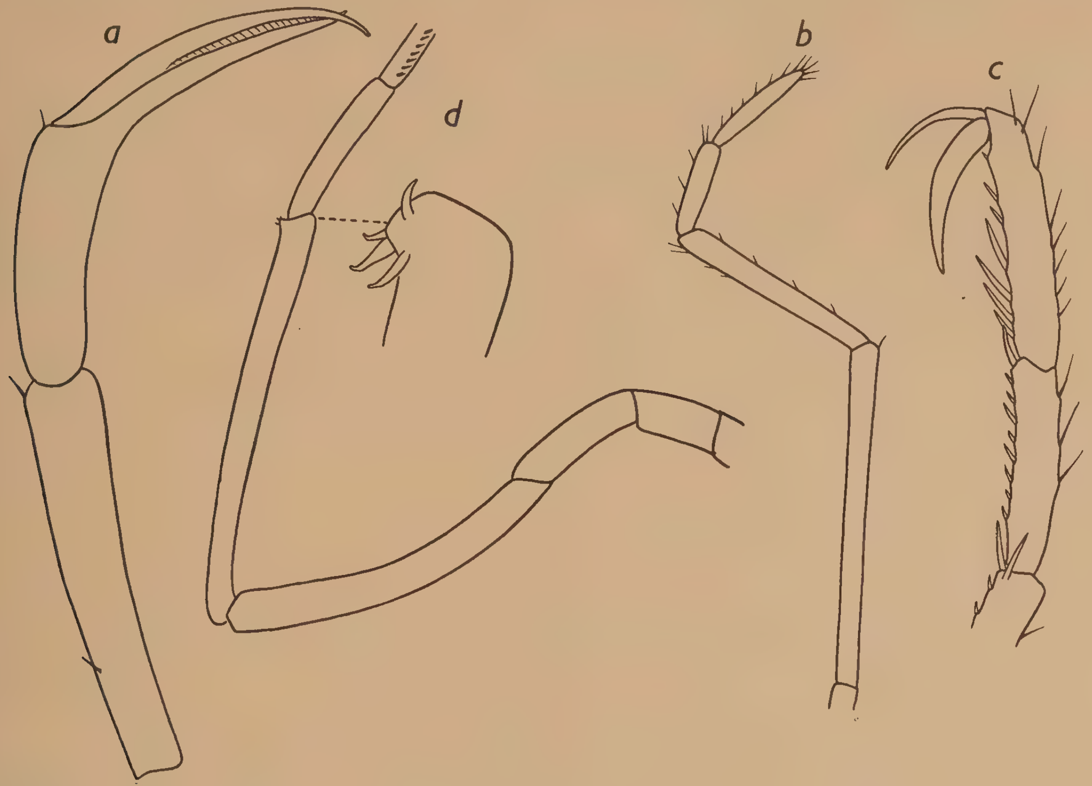

Fig. 37. *Nymphon angolense*, n.sp.: *a*. Chelophore. *b*. Palp. *c*. Terminal segments of third leg. (All × 27.) *d*. Segments 1–7 of male oviger: × 20, and distal end of fifth segment: × 60.

Genus **Heteronymphon**, n.g.

Diagnosis. Body smooth, rather compact, segmented, with well-defined lateral processes; cephalic segment with short thick neck and low wide ocular tubercle situated in front of neck and between the two anterior lobes of cephalon. Chelophores long, slender; chela not exceeding half the length of the scape. Palp five-jointed. Oviger ten-jointed with denticulate spines on the four terminal segments, but without terminal claw; fifth segment in male relatively short and considerably expanded distally (like that of group II in the genus *Nymphon*).

Remarks. In general appearance the specimens referred to this genus resemble those belonging to the smaller species of *Nymphon* with short neck, e.g. *Nymphon pfefferi*. But the anterior position of the ocular tubercle[1] and the absence of the terminal claw on the oviger separates this form from all species of the genus *Nymphon*. These two characters are also found in the genus *Nymphonella*, Ohshima (1927, p. 257), but the latter would appear to belong to the Eurycididae rather than the Nymphonidae, since the chelophore is reduced, the palp has nine segments, and the proboscis is "directed ventrad".

[1] The ocular tubercle is never situated in front of the point of insertion of the oviger in *Nymphon*.

The genus *Heteronymphon* serves to link the Nymphonidae to the Phoxichilidae (Pallenidae) on the one hand and to the Phoxichilidiidae on the other. In the former family the terminal claw of the oviger is sometimes wanting or vestigial; in the latter family the ocular tubercle is situated near the anterior border of the cephalon in, e.g., *Phoxichilidium australe*.

Loman (1908, table facing p. 19) uses the oviger as a basis for his first division of the order Pantopoda. Bouvier (1913, p. 34) has pointed out that this division into a section with and a section without a terminal claw to the oviger is not altogether satisfactory. The genus *Heteronymphon* adds yet another exception to the first section, since the terminal claw of the oviger is absent and several of the terminal denticulate spines are enlarged, presumably to take the place of the claw (Fig. 39 *d*).

Heteronymphon kempi, n.sp. (Figs. 38 and 39).

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 1 specimen, probably ♂.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 1 ♂, with *N. pfefferi*.

St. MS 66. 28. ii. 26. East Cumberland Bay, 2¼ miles SE of King Edward Point Light to 1½ cables W × N of Macmahon Rock, 18 m. Small beam trawl: 1 ♀ (length of trunk = 1·4 mm.) and 1 immature specimen.

St. MS 71. 9. iii. 26. East Cumberland Bay, 9¼ cables E × S to 1·2 miles E × S of Sappho Point, 60–110 m. Small beam trawl: 3 ♀♀ including holotype.

St. MS 74. 17. iii. 26. East Cumberland Bay, 1 cable SE × E of Hope Point to 3·1 miles SW of Merton Rock, 22–40 m. Small beam trawl: 1 specimen (sex uncertain, probably immature), with *N. brevicaudatum*; 1 ♀ with *N. pfefferi*.

DESCRIPTION OF HOLOTYPE (♀). *Trunk* rather compact, lateral processes separated by approximately their own diameter, articulations between the segments well marked. Cephalic segment less than half the length of the trunk, neck short and thick. Ocular tubercle low and broad, situated in front of neck near the anterior border of cephalon, eyes large (Fig. 38 *a* and *b*).

Proboscis slightly decurved, approximately as long as cephalic segment, subcylindrical, rounded at apex.

Abdomen long, slender, very much elevated.

Chelophore slender; scape rather longer than proboscis; chela not exceeding half the length of the scape, fingers scarcely longer than palm armed with fifteen and nineteen spinules respectively (Fig. 39 *b*).

Palp five-jointed; third joint the longest, one-fourth as long again as the fifth and nearly twice as long as second (Fig. 39 *a*).

Oviger ten-jointed; first three segments together somewhat longer than fourth, which is only slightly shorter than fifth. Number of denticulate spines on each of the four terminal segments five, five, four and seven (in female from MS 66 nine, six, six and eight). There is no terminal claw, but the last three or four denticulate spines are considerably longer than the others on segment 10 (Fig. 39 *d*).

Leg with ova visible in femur and the two distal coxae. Second coxa equal to the other two together, with a distinct prominence on the dorsal surface (Fig. 38 *c*). Femur and first tibia equal, second tibia the longest segment. Propodus nearly twice as long as tarsus and more than twice as long as the main claw. Auxiliary claws absent.

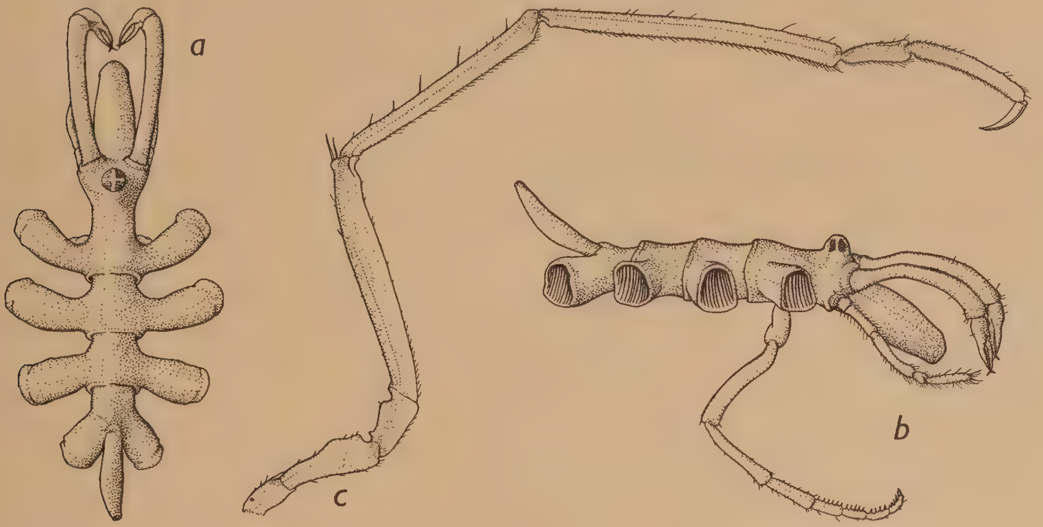

Fig. 38. *Heteronymphon kempi*, gen. et sp.n.: *a*. Holotype; dorsal view of body with chelophores. *b*. Holotype, lateral view of body with chelophores, palp and oviger. *c*. Third leg.

Measurements (*mm.*)

Length of proboscis	0·55
Diameter of proboscis	0·20
Length of trunk	1·25
Length of cephalic segment	0·54
Width of cephalic lobes	0·30
Width across second lateral processes	1·00
Length of abdomen (animal placed in natural position)	0·44
Third leg:	
First coxa	0·30
Second coxa	0·70
Third coxa	0·40
Femur	1·80
First tibia	1·80
Second tibia	2·20
Tarsus	0·50
Propodus	0·93
Claw	0·36

REMARKS. Although the specimens are very small the genital pores are conspicuous in all the females. The largest specimen is the adult from MS 66, and it is quite probable that this female has the full number (29) of denticulate spines on the oviger for the species.

The single male specimen has both ovigers mutilated, but fortunately the fifth segment is present on one side (Fig. 39 *c*); it is relatively short compared to the fourth segment and is considerably expanded or clubbed distally as in group II of the genus *Nymphon* (cf. Figs. 39 *c* and 27).

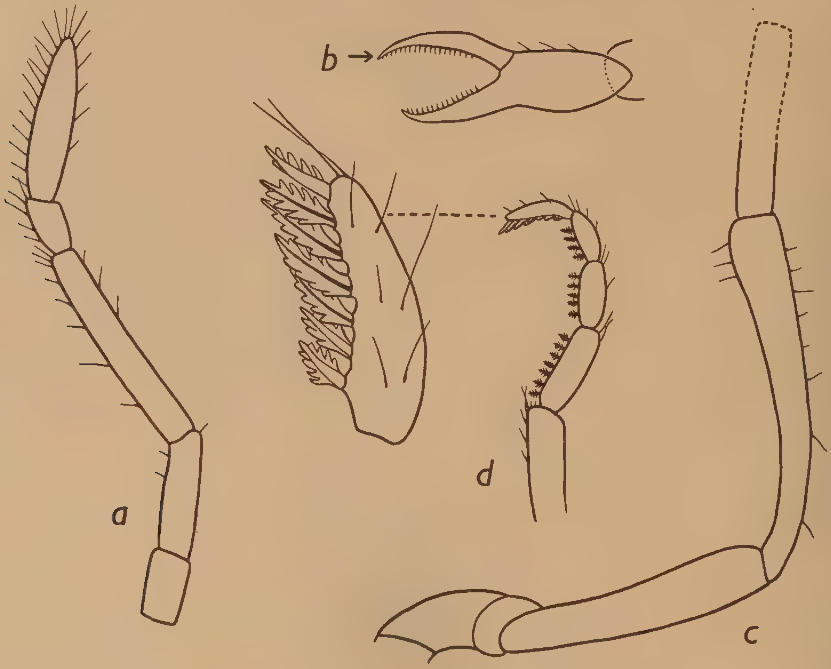

Fig. 39. *Heteronymphon kempi*, gen. et sp.n.: *a*. Palp. *b*. Chela. *c*. Segments 3–5 of male oviger—6 incomplete. *d*. Segments 7–10 of female oviger with 10th segment further enlarged—the denticulate spines are not accurately represented in the smaller figure. (*a* and *b*: × 100; *c* and *d*: × 60 and *circ*. 240.)

The relative proportions of palpal segments 2–5 differ markedly from those of any Antarctic species of the genus *Nymphon*.

Family PHOXICHILIDAE (PALLENIDAE)

Genus **Pallene**, Johnston

Pallene margarita, n.sp. (Figs. 40 and 41).

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m.; M. Large otter trawl: 3 specimens.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 3 specimens including 1 ♂ bearing ova and larvae.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W, 155–178 m.; gn. M. S. Large otter trawl: 1 ♂.

St. WS 212. 30. v. 28. 49° 22′ S, 60° 10′ W, 242–249 m.; gn. S. M. Commercial otter trawl: many specimens including ovigerous ♂♂.

St. WS 214. 31. v. 28. 48° 25′ S, 60° 40′ W, 208–219 m.; f. d. S. Commercial otter trawl: 1 ovigerous ♂.

St. WS 227. 12. vi. 28. 51° 08′ S, 56° 50′ W, 320–298 m.; f. gn. S. Commercial otter trawl: many specimens including ovigerous and larvigerous ♂♂.

St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, 229–236 m.; Sh. c. w. S. Commercial otter trawl: 5 specimens, including larvigerous ♂.

St. WS 229. 1. vii. 28. 50° 35′ S, 57° 20′ W, 210–271 m.; f. gn. S. Commercial otter trawl: many specimens, including ovigerous and larvigerous ♂♂.

St. WS 234. 5. vii. 28. 48° 52′ S, 60° 25′ W, 195–207 m.; f. gn. S. Commercial otter trawl: 3 specimens.

St. WS 237. 7. vii. 28. 46° 00′ S, 60° 05′ W, 150–256 m.; c. br. S. Sh. Commercial otter trawl: 1 larvigerous ♂.

St. WS 244. 18. vii. 28. 52° 00′ S, 62° 40′ W, 253–247 m.; f. d. S. M. Commercial otter trawl: 1 larvigerous ♂.

St. WS 245. 18. vii. 28. 52° 36′ S, 63° 40′ W, 304–290 m.; d. gn. S. Sh. Commercial otter trawl: 1 ♀, 3 ovigerous and larvigerous ♂♂.

DESCRIPTION OF HOLOTYPE.[1] *Trunk* segmented, of rather loose build; lateral processes, with the exception of the last two pairs, separated by more than their own diameter. Cephalic segment much longer than the sum of the three posterior segments, and considerably expanded anteriorly; neck long. Ocular tubercle bluntly conical, a

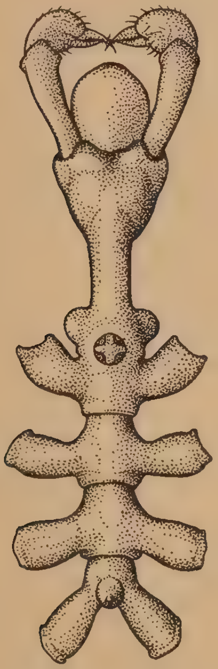

Fig. 40. *Pallene margarita*, n.sp. Dorsal view of body with chelophores: × 20.

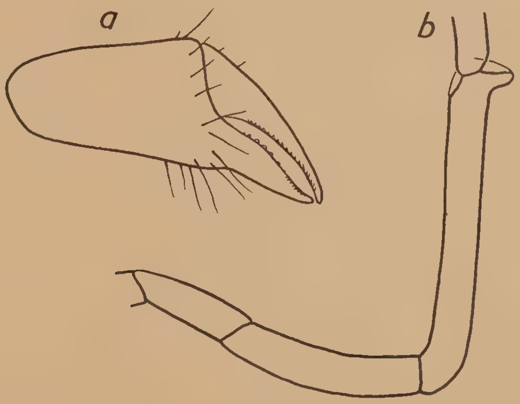

Fig. 41. *Pallene margarita*, n.sp.: *a*. Chela: × 90. *b*. Segments 3–5 of male oviger: × 33.

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[1] A larvigerous male from St. WS 229.

little higher than wide; eyes well developed. Oviger base small and situated a short distance in front of first lateral process (Fig. 40).

Proboscis short, stout, sub-cylindrical.

Abdomen short, elevated at an angle of 80–90° and reaching to middle of fourth lateral process.

Chelophore short. Scape equal to proboscis and approximately two and a half times as long as wide distally. Chela as represented in Fig. 41 *a*; movable finger equal to palm; 7–8 minute teeth on immovable one.

Palp absent (as also in the female).

Oviger. Terminal claw absent; spines on the four terminal segments short, rather broad and rounded distally, numbering 49[1] (14 + 11 + 12 + 12). Fifth segment relatively long and furnished with the usual distal lobe (Fig. 41 *b*).

Third leg. Second coxa long and slender, more than twice the sum of the first and third (dorsal measurements). Femur subequal to first tibia and at least nine times as long as wide. Second tibia the longest segment. Tarsus very small; 4–5 long spines on proximal sixth of ventral margin of propodus. Claw and auxiliaries long and slender.

In the *female* the femur is considerably dilated in the proximal two-thirds and the fifth segment of the oviger is relatively short, without the distal lateral lobe.

Measurements (*mm*.)

	Holotype	♀ (St. WS 227)
Length of proboscis	0·6	0·7
Diameter of proboscis	0·4	0·5
Length of trunk	2·6	3·0
Length of cephalic segment	1·67	2·0
Width of cephalic lobes	0·65	0·75
Width of neck	0·22	0·3
Width across second lateral processes	1·2	1·3
Length of abdomen	0·3	0·25
Third leg:		
First coxa	0·45	0·5
Second coxa	1·73	1·73
Third coxa	0·27	0·35
Femur	2·9	3·6
First tibia	2·9	3·53
Second tibia	3·6	4·4
Tarsus	0·1	
Propodus	0·93	
Claw	0·64	
Auxiliaries	0·5	

REMARKS. This species appears to belong to the genus *Pallene*, but the two terminal body segments are not fused as in the majority of the other species—a condition that is also found, e.g., in *P. emaciata*, Dohrn.

The genus is seldom represented in Antarctic collections. Bouvier (1913, p. 20 and

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[1] 48–56 in adults.

p. 96) mentions *P. dimorpha*,[1] Hoek, as the only Antarctic species (from Kerguelen). *P. margarita* differs from the latter chiefly in that the terminal claw of the oviger is entirely suppressed and the palp is absent in both sexes.

Genus **Austropallene**, Hodgson

Austropallene cornigera (Möbius) (Figs. 42 and 43).

Calman, 1915, p. 38, *ubi synon. et lit.*
Loman, 1923, p. 22.

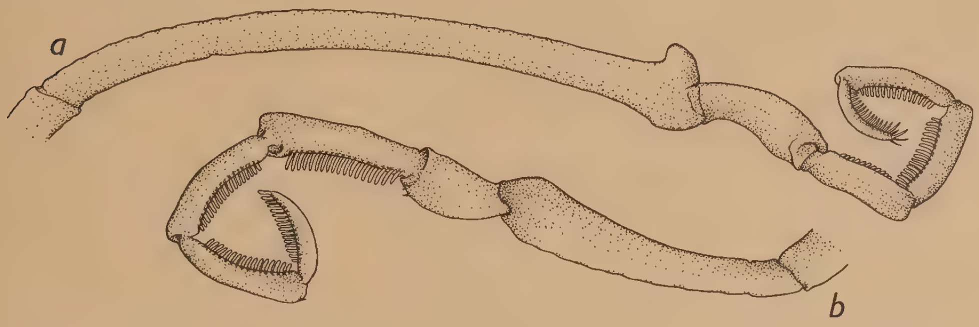

Fig. 42. *Austropallene cornigera* (Möbius). Segments 5–10 of oviger of *a*, male; *b*, female.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 3·3 miles S 45° E of Jason Light, 110 m.; M. R. Large dredge: 1 ♂.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m.; M. Large otter trawl: 3 ♀♀.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 1 immature specimen probably belongs to this species.

St. 156. 20. i. 27. 53° 51′ S, 36° 21′ 30″ W, 200–236 m.; R. Large heavy dredge: 1 ♀.

St. 159. 21. i. 27. 53° 52′ 30″ S, 36° 08′ W, 160 m.; R. Large heavy dredge: 1 larvigerous ♂.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ 00″ W, 342 m.; R. Large heavy dredge: 16 specimens, including 5 ovigerous ♂♂, accompanied by the following note: "White-spotted Pycnogon. Horn-coloured. Abdomen [trunk] opposite 2 middle pairs of legs with a white dorsal patch. All legs with a white spot at distal end of segments 3, 4, 5 and 6, with, in addition, one spot at proximal end of segment 5".

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 63° 17′ 20″ S, 59° 48′ 15″ W, 200 m.; m. St. G. Large dredge: 1 ovigerous ♂ and 1 young ? ♀.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° W, 160–335 m.; M. Large otter trawl: 1 ovigerous ♂, rather slender, but apparently this species.

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[1] Schimkewitsch (1930) has established a new genus, *Oropallene*, for Hoek's species. According to Flynn (1919, p. 77) *Pallene valida*, Haswell, would also belong to *Oropallene*. Schimkewitsch appears to have carried the multiplication of genera within the family Phoxichilidae (Pallenidae) to the utmost extreme and characters such as (1) the presence or absence of auxiliary claws, (2) the fusion or non-fusion of two body segments, (3) the presence or absence of a rudimentary palp, and (4) the presence or absence of a terminal claw on the oviger assume far more importance in this than in almost any other family.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W, 259 m.; M. Large dredge: 2 ♂♂, 1 ♀.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ 00″ S, 58° 28′ 30″ W, 391 m.; M. St. Medium otter trawl: 1 ovigerous ♂, with *Nymphon charcoti*.

St. 363. 26. ii. 30. 2·5 miles S 80° E of SE point of Zavodovski Island, South Sandwich Islands, 329–278 m.; Sc. Large dredge: 1 larvigerous ♂, 1 ovigerous ♂.

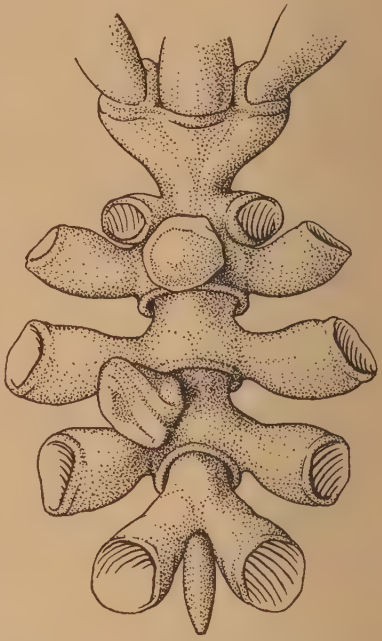

Fig. 43. *Austropallene cornigera* (Möbius). Ventral view of body showing two (?) egg-cases of some animal adhering to the epidermis.

REMARKS. The white spots mentioned in the note on the label (St. 170) are still quite clear in the preserved specimens from this station and are present, though less well marked, in specimens from some of the other stations also.

The spurs on the cephalon are longer and more slender in the specimens from St. 42, 156 and 159 and the short spinous projection on each lateral process is more pronounced than is typical of the species.

Segments 5–10 of the male and female ovigers are represented in Fig. 42 *a* and *b*. The two globular bodies attached to the ventral surface of the specimen from St. 187 (Fig. 43) appear to be egg cases of some animal; they can be detached without damaging the Pycnogon and are apparently only glued on to the specimen.

Austropallene brachyura (Bouvier).

Calman, 1915, p. 39, *ubi synon. et bibl.*

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 1 immature specimen probably belongs to this species, but the neck is somewhat longer than is typical.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W, 259 m.; M. Large dredge: 1 ♀.

Austropallene cristata (Bouvier).

Pseudopallene cristata, Bouvier, 1911, p. 1138; 1913, p. 102, figs. 55–59.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W, 155–178 m.; gn. M. S. Large otter trawl: 1 immature specimen.

Family PHOXICHILIDIIDAE

Genus Pallenopsis, Wilson

Pallenopsis pilosa (Hoek).

Phoxichilidium pilosum, Hoek, 1881, p. 90, pl. xiii, figs. 10–13.
Pallenopsis pilosa, Hoek (1883), p. 9 (in list of species).
Pallenopsis pilosa, Hodgson, 1907, p. 15, pl. ii, fig. 2.
Pallenopsis pilosa, Bouvier, 1911, p. 1139; 1913, p. 107, figs. 60 and 61.

St. 170. 23 .ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 1 ♂, 1 ?♀ (genital pores not formed), 1 young specimen.

St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 63° 17′ 30″ S, 61° 17′ W, 1080 m.; M. c. St. Large dredge: 1 immature specimen, with *Nymphon brevicaudatum*.

St. 180. 11. iii. 27. 1·7 miles W of N point of Gand Island, Schollaert Channel, Palmer Archipelago, 160–330 m.; M. St. Large otter trawl: 1 immature specimen with *N. australe*.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W, 160–335 m.; M. Large otter trawl: 1 ♂, 4 immature specimens.

St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 21′ S, 62° 58′ W, 278–500 m.; M. Large otter trawl: 1 ovigerous ♂, 1 ♀, 1 immature specimen.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W, 259–354 m.; M. Large otter trawl: 1 ♂, 1 ♀, 1 immature specimen.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 64° 56′ S, 65° 35′ W, 315 m.; M. R. Large dredge: 1 ♀ (with small Cirripede attached).

St. 458. 19. x. 30. 7 miles S 50° W of Cape Circumcision, Bouvet Island, 357–377 m. Large dredge: 1 ♂ with *N. australe*.

REMARKS. The majority of the specimens are rather more compactly built and more hairy than the types, with which they agree in other respects. Several of the specimens are light brown, the others being of a pale yellowish colour.

Measurements (*mm.*)

	St. 182, ♂ (ovig.)	St. 190 ♀
Length of proboscis[1]	3·4	4·0
Diameter of proboscis[1]	1·4	1·65
Length of trunk	6·2	7·2
Width across second lateral processes	4·8	5·2
Length of cephalic segment	3·6	4·0
Length of abdomen	3·6	4·4
Length of scape	2·0 + 1·8	2·4 + 2·4
Length of chela	1·87	2·0
Third leg:		
First coxa	1·6	1·6
Second coxa	3·2	3·2
Third coxa	1·07	1·2
Femur	7·6	10·4
First tibia	7·6	10·0
Second tibia	9·2	12·0
Tarsus	0·3	0·5
Propodus	2·6	3·0
Claw	1·8	2·0
Auxiliaries	0·67	

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[1] Measured laterally, not dorsally as in other species.

Distribution. Eastern and Western Antarctic; from deep water at lat. 46° 16′ S, long. 48° 27′ E and lat. 53° 55′ S, long. 108° 35′ E.

Pallenopsis patagonica (Hoek) (Fig. 44).

Phoxichilidium patagonicum, Hoek, 1881, p. 84, pl. xii, figs. 6–9.
Phoxichilidium patagonicum var. *elegans*, Hoek, 1881, p. 86, pl. xii, fig. 10.
Pallenopsis hiemalis, Hodgson, 1907, p. 17 in part—? not the type specimen.
? *Pallenopsis glabra*, Möbius, 1902, p. 184, pl. xxvii, figs. 1–6. Bouvier, 1913, p. 109, figs. 62–65.
Pallenopsis glabra, Hodgson, 1907, p. 11; Calman, 1915, p. 41.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W, 122–136 m.; gn. M. St. Large otter trawl: 1 ♂, 2 ♀♀.

St. 167. 20. ii. 27. Off Signy Island, South Orkneys, 60° 50′ 30″ S, 46° 15′ W, 244–344 m.; gn. M. Large otter trawl: 1 ♂ with encrusting Polyzoa.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W, 259–354 m.; M. Large otter trawl: 1 large ♀.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 64° 56′ S, 65° 35′ W, 93–315 m.; M. R. Large rectangular net: 1 ♀.

St. WS 83. 24. iii. 27. 14 miles S 64° W of George Island, East Falkland Island, from 52° 28′ S, 60° 06′ W to 52° 30′ S, 60° 09′ 30″ W, 137–129 m.; f. gn. S. Sh. Commercial otter trawl: 3 ♀♀, 2 immature specimens.

St. WS 84. 24. iii. 27. 7½ miles S 9° W of Sea Lion Island, East Falkland Island, from 52° 33′ S, 59° 08′ W to 52° 34′ 30″ S, 59° 11′ W, 75–74 m.; c. S. Sh. St. 1 ovigerous ♂, egg-mass simple but attached to both ovigers: 6 small specimens, including 2 ♂♂ (1 ovigerous) and 1 ♀ with genital pores open, may belong to this species. Several of the specimens carry encrusting Polyzoa.

St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Island, from 52° 09′ S, 58° 14′ W to 52° 08′ S, 59° 09′ W, 79 m.; S. Sh. Commercial otter trawl: 7 specimens, very hairy; 1 ♀ has the genital pores visible, the others are probably all immature.

St. WS 88. 6. iv. 27. 54° 00′ S, 64° 57′ 30″ W, from 54° 00′ S, 65° 00′ W to 54° 00′ S, 64° 55′ W, 118 m.; S. Sh. St. Commercial otter trawl: 1 ♀ and ? 1 very young specimen with a long tapering point to ocular tubercle.

St. WS 91. 8. iv. 27. 52° 53′ 45″ S, 64° 37′ 30″ W, from 52° 54′ 30″ S, 64° 39′ W to 52° 53′ S, 64° 36′ W, 191–205 m.; f. d. S. Sh. Commercial otter trawl: 1 ♀.

St. WS 92. 8. iv. 27. 51° 58′ 30″ S, 65° 01′ W, from 52° 00′ S, 65° 00′ W to 51° 57′ S, 65° 02′ W, 145–143 m.; f. d. S. St. Commercial otter trawl: 2 ♂♂, 1 ovigerous with a single egg-mass carried by both ovigers.

St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, West Falkland Island, from 51° 51′ S, 61° 30′ W to 51° 54′ S, 61° 30′ W, 133–130 m.; gy. S. Commercial otter trawl: 4 small specimens, including 2 ♂♂ (1 ovigerous), bearing adherent Foraminifera.

[1]St. WS 210. 29. v. 28. 50° 17′ S, 60° 06′ W, 161 m.; gn. S. Commercial otter trawl: 1 ♀.

St. WS 214. 31. v. 28. 48° 25′ S, 60° 40′ W, 208–219 m.; f. d. S. Commercial otter trawl: 1 specimen.

St. WS 215. 31. v. 28. 47° 37′ S, 60° 50′ W, 219–146 m.; f. gn. S. Commercial otter trawl: 1 specimen.

[1] The specimens from WS 210 to the end of the list probably belong to this species; they are mostly of small size and compact build.

St. WS 225. 9. vi. 28. 50° 20′ S, 62° 30′ W, 162–161 m.; gn. S. Sh. Commercial otter trawl: 1 specimen.

St. WS 234. 5. vii. 28. 48° 52′ S, 60° 25′ W, 195–207 m.; f. gn. S. Commercial otter trawl: 1 ovigerous ♂.

St. WS 237. 7. vii. 28. 46° 00′ S, 60° 05′ W, 150–256 m.; c. br. S. Sh. Commercial otter trawl: 3 specimens (1 was apparently undergoing a moult when captured).

St. WS 243. 17. vii. 28. 51° 06′ S, 64° 30′ W, 144–141 m.; c. d. S. Commercial otter trawl: 1 ovigerous ♂.

St. WS 244. 18. vii. 28. 52° 00′ S, 62° 40′ W, 253–247 m.; f. d. S. M. Commercial otter trawl: 3 ♀♀, 2 immature specimens.

St. WS 245. 18. vii. 28. 52° 36′ S, 63° 40′ W, 304–290 m.; d. gn. S. Sh. Commercial otter trawl: 5 ♀♀, 3 ♂♂ (2 ovigerous) and several young specimens.

St. WS 246. 19. vii. 28. 52° 25′ S, 61° 00′ W, 267–208 m.; c. gn. S. P. Commercial otter trawl: 4 specimens, including 1 ovigerous ♂.

REMARKS. Calman, 1915, p. 42, has suggested that *Phoxichilidium patagonicum*, Hoek, is identical with *Pallenopsis glabra*, Möbius. All the syntypes in the Challenger collection are females; the genital pores are quite distinct in all, although the oviger is not fully developed in the smallest individual. Calman has also commented on the compactness of the body in the Challenger specimens as compared with the Terra Nova material described as *Pallenopsis glabra*.

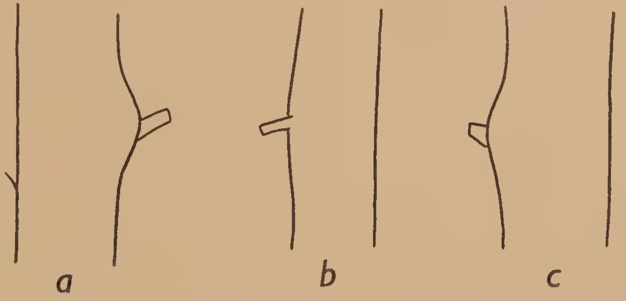

Fig. 44. *Pallenopsis patagonica* (Hoek). Femoral gland-tubercle of male. *a*. Trunk length = 11·2 mm., St. WS 92. *b*. A smaller specimen from St. WS 84. *c*. Trunk length = 10·7 mm. from St. WS 92.

The material in the Discovery collection is, for the most part, of the compact type and was also collected from the Falkland Island area. The largest specimens from this region, e.g. the adult from WS 88, is very similar to the largest Challenger syntype. The small specimens tend to have the lateral processes but little separated and to have rather long fine setae on the walking legs. The smallest specimen from the more southern region (that from St. 190, length = 9·5 mm.) also has the lateral processes of the body but little separated and setose legs. The largest specimens (Sts. 140 and 187) have the lateral processes separated by a distance equal to their own diameter.

Although this species reaches a considerable size in the more southern, colder region, the males reach maturity early and carry ova when they have reached a length of 7–7·5 mm. (from ocular tubercle to tip of abdomen). The genital pores, also, are formed in the females when they reach a length of about 8–9 mm., but the ovigers are not fully developed until later. Even in adult females two of the four terminal segments (7 and 8) are nearly always more or less fused together, as figured by Bouvier (1913, p. 111, fig. 64).

The femoral gland is quite prominent in small males (Fig. 44); in the two males from WS 92 it is situated on a raised mound[1] (Fig. 44 *a*, *c*), but is much shorter in one specimen than in the other. In the male specimen of the first Discovery Expedition, described by Hodgson under *P. hiemalis*, 1907, p. 19, the femoral gland is still shorter, and in the male from St. 140 it is not visible to the naked eye.

Table VII

Specimen	Station	Length of trunk plus abdomen in mm.	Relative lengths of segments 2–6 of oviger				
			2	3	4	5	6
♂	167	12·0	1	0·84	1·66	1·93	0·89
♂	140	15·0	1	0·78	1·38	1·38	0·70
♂	WS 93	9·0	1	0·87	1·60	1·60	0·80
♂	WS 92	11·2	1	0·77	1·20	1·20	0·62
♂	Valdivia	?	1	0·50	0·93	1·30	0·58
♀	Valdivia	16·0	1	0·93	1·19	1·19	0·73
♀	187	17·3	1	0·81	1·31	0·89	0·65
♀	140	14·8	1	0·80	1·32	1·16	0·68
♀	Challenger syntype	12·2	1	0·70	1·06	0·81	0·56

Table VIII

Specimen	Station	Length of trunk plus abdomen in mm.	Third right leg (length of segments in mm.)		
			Femur	Tibia 1	Tibia 2
♀	187	17·3	18·8	14·7	22·3
♂	140	15·0	17·4	15·1	23·1
♀	140	14·8	19·6	15·6	24·4
♀	190	9·4	9·6	8·5	11·4
? ♀	WS 84	7·4	6·75	6·75	9·4
? ♀	WS 93	8·0	8·6	8·3	10·7

The type specimen of *P. hiemalis* differs from all specimens of *P. patagonica* examined (1) in the size and arrangement of the spines on the ventral surface of the propodus (cf. Hodgson, 1907, pl. ii, figs. 3, 3 *a*), (2) in having a very well-developed tubercle on each lateral process, and (3) in having relatively longer and narrower vestiges of the palps. Most specimens of *P. patagonica* have 2–4, generally three, very long spines at the proximal end of the propodus and the rest are very small; whereas in the type of *P. hiemalis* (♀) the spines on the propodus are all of uniform size. The specimens from St. 140, however, exhibit an intermediate condition, the proximal six or more spines being relatively long, the others decreasing gradually in size.

DISTRIBUTION. Eastern and Western Antarctic and Magellan District.

Pallenopsis spicata, Hodgson.

Hodgson, 1914–15, p. 146.
Calman, 1915, p. 44, text-fig. 9.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 1 immature specimen.

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[1] Also in males from WS 210 to the end of the list.

REMARKS. This is undoubtedly an immature specimen of *P. spicata*, Hodgson. It agrees in most respects with the Terra Nova specimen; the following differences are doubtless mostly due to the fact that the specimen is not fully developed. (1) The lateral processes are less widely separated, so that the cephalic segment is slightly longer than the sum of the two succeeding segments. (2) The oviger is not fully developed, is shorter than the proboscis and divided into only four segments. (3) The walking legs are relatively short (6·7 instead of 9 times the trunk length), and the spinules are set on higher tubercles.

Measurements (*mm.*)

Length of proboscis	2·8
Greatest width of proboscis	1·5
Length of cephalic segment	2·6
Width of anterior cephalic lobes ...	2·4
Length of trunk	5·2
Width across second lateral processes	5·07
Length of abdomen	1·7

Third leg:	
First coxa	1·0
Second coxa	3·2
Third coxa	0·8
Femur	8·0
First tibia	7·2
Second tibia	10·8
Tarsus	0·27
Propodus	2·4
Claw	1·2

DISTRIBUTION. Previously recorded from Gauss winter quarters and McMurdo Sound.

? Pallenopsis sp. (Fig. 45).

St. 256. 23. vi. 27. 35° 14′ S, 6° 49′ E, 850–1100 (–0) m. Young fish trawl: 1 immature specimen. Pelagic pycnogon!

DESCRIPTION. *Trunk* distinctly segmented; lateral processes separated proximally by narrow intervals, distally by rather more than their own diameter. Cephalic segment equal to the sum of the three posterior segments; cephalon little produced over base of proboscis, occupying about half the length of cephalic segment, scarcely wider than long. Ocular tubercle as high as its basal diameter, recumbent, nearly as wide as cephalon; eyes small, rounded and prominent, apparently reduced to one pair (Fig. 45 *c*).

Proboscis long, slender, slightly expanded in middle and again at apex, almost equal in length to scape.

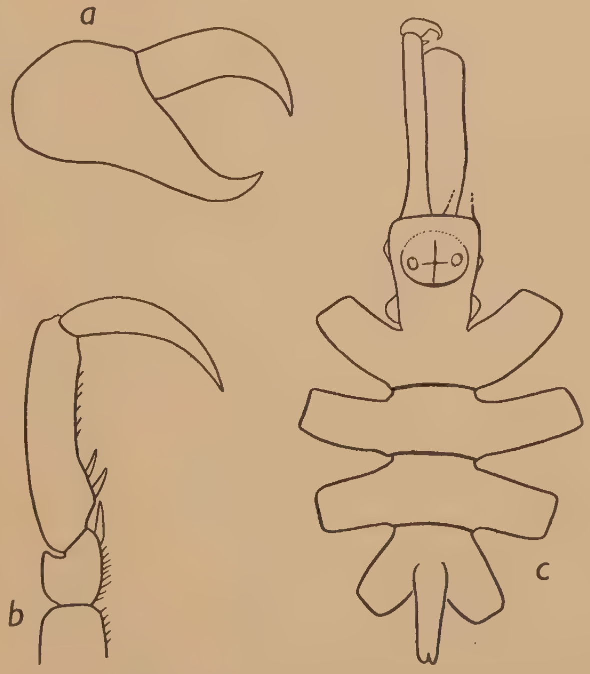

Fig. 45. ? *Pallenopsis*, sp. Young: *a*. Chela: × 100. *b*. Terminal segments of walking leg: × 60. *c*. Dorsal view of body with left chelophore: × 27.

Abdomen long, sub-cylindrical, blunt, almost vertical.

Chelophore long and slender.[1] Scape distinctly two-jointed, the first nearly twice as long as the second segment. Chela small; fingers longer than palm, gaping when closed (Fig. 45 *a*).

Palp an elongated papilla between base of chelophore and oviger.

Oviger already ten-jointed, although segments 9 and 10 are not completely separated off from each other; reaching to tip of proboscis when straightened out. The right oviger is bifurcated near the tip (Fig. 74 *c*).

Third leg long and slender. Second coxa half as long again as the sum of the first and third. Second tibia shorter than either of the two preceding segments; first tibia the longest segment. Tarsus very short, propodus with two prominent spines proximally on the ventral margin. Claw long, auxiliaries absent (Fig. 45 *b*). There are no setae on the trunk and only a few spinose setae near the distal end of the leg.

Measurements (mm.)

		Third leg:	
Length of proboscis	1·07	First coxa	0·4
Diameter of proboscis near tip	0·3	Second coxa	1·2
Length of trunk	1·8	Third coxa	0·4
Width across second lateral processes	1·35	Femur	3·24
Length of cephalic segment	0·85	First tibia	3·5
Width of cephalon	0·47	Second tibia	2·87
Length of abdomen	0·5	Tarsus + propodus	0·7
Length of scape	1·2	Claw	0·35

Remarks. This specimen is not quite mature, no genital pores can be distinguished. It appears to belong to the genus *Pallenopsis*, but does not belong to any of the species previously recorded from South African waters. There can be no doubt that the species is pelagic, for the total depth at the locality in which this specimen was obtained exceeds 4000 m.[2] No pelagic species of *Pallenopsis* appears to have been previously described, but Flynn (1928, p. 25) has described a pelagic species of *Anoplodactylus* from off Port Natal.

The specimen probably belongs to a small species characterized by (1) the almost complete absence of setae, (2) the complete suppression of the auxiliary claws on the legs, and (3) the presence of but one pair of eyes.

Genus **Phoxichilidium**, Milne-Edwards

Phoxichilidium australe, Hodgson.

Hodgson, 1915, p. 145.
Calman, 1915, p. 46, fig. 10 A–D.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 2 ♀♀.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W, 259–354 m.; M. Large otter trawl: 1 ♂.

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[1] Length of scape eight to nine times the distal width.

[2] The specimen could not have got into the net from dredged material obtained elsewhere: for nearly two months prior to its capture plankton nets only were in use.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 64° 56′ S, 65° 35′ W, 93–126 m.; R. Large dredge: 1 ♀, 1 ♂, 1 ovigerous ♂.

Distribution. Previously recorded from the Gauss winter quarters and McMurdo Sound.

Family ENDEIDAE

Genus Endeis, Philippi

Endeis australis (Hodgson).

Phoxichilus australis, Hodgson, 1907, p. 5, pl. i, fig. 1.
Phoxichilus australis, Bouvier, 1913, p. 118, text-fig. 74.
Endeis australis, Calman, 1915, p. 49, text-fig. 11.

St. 174. 28. ii–2. iii. 27. Deception Island, South Shetlands, outside entrance W of Light, 5–10 m. In fish trap: 1 ovigerous ♂.

Remarks. This specimen has been referred to *Endeis australis* because, although smaller and of more compact build with shorter stouter legs than is typical for the species, it shows no distinctive differences that might be deemed of specific importance.

The oviger appears to have only seven segments both in the Discovery specimen and in the Terra Nova specimen for which measurements are given below (cf. Bouvier, 1913, p. 119, fig. 74).

Calman (1915, p. 49) states that the orifices of the cement glands could not be discerned in the male specimens, but in the male from Terra Nova St. 314 there are 30–35 small whitish papillae in linear series on the proximal three-fourths of the posterior surface of *each* walking leg (cf. Bouvier, 1913, p. 119: "Les orifices des glandes à cément sont situés sur de petites saillies qui forment une rangée longitudinale à la face postérieure des pattes des trois dernières paires"). These papillae are also present on all four legs in the Discovery specimen, but are fewer in number (20–25 on each femur).

Measurements (mm.)

	Terra Nova St. 314, ♂	Discovery St. 174, ♂
Length of proboscis	2·93	2·0
Diameter of proboscis	0·8	0·67
Length of trunk	4·0	2·93
Width across second lateral processes	3·0	2·4
Length of cephalic segment	1·33	1·1
Length of trunk ÷ length of proboscis	1·36	1·47
Third leg:		
First coxa	0·8	0·6
Second coxa	2·8	1·6
Third coxa	0·8	0·6
Femur	7·2	4·0
First tibia	6·8	3·4
Second tibia	8·2	4·53
Tarsus and propodus	2·2	1·9
Claw	0·9	0·67
Auxiliaries	0·42	0·4
Length of second coxa ÷ length of first and third coxae ...	1·75	1·33
Length of second coxa ÷ greatest width of second coxa	3·5	2·4

Distribution. Antarctic: (1) Ross Sea area; (2) Margaret Bay, near Doumer Island, Palmer Archipelago, and South Shetlands.

Family AMMOTHEIDAE

Genus Ammothea, Leach

Ammothea, Leach, 1814, p. 33. Bouvier, 1913, p. 123. Calman, 1915, p. 49.
Leionymphon, Möbius, 1902, p. 183. Hodgson, 1907, p. 39.

The total number of specimens belonging to the genus *Ammothea* represents a small percentage of the entire collection, yet no fewer than five new species, each with one or two well-defined characters, are represented. Of these *A. tetrapora* is unique in having four, instead of the usual two pairs of male genital openings. Two species have each an eight-jointed palp as in the genus *Achelia* (see Bouvier, 1913, p. 122, key), but they are of much larger size, and the high transverse body ridges characteristic of the genus *Ammothea* are present. Two species, both of large size, retain the chelate chelophore in the adult (*A. gigantea* and *A. striata*).

The proboscis varies greatly in relative length and in shape from species to species. As a rule it is straight, though much curved in *A. striata*, and either pyriform or subcylindrical. In three different forms (*A. longispina*, Fig. 51, *A.* sp.? and *A. stylirostris*, Fig. 56) it is widest at the base, which is surrounded by a distinct collar, and then tapers gradually to a rather narrow point,[1] forming a long piercing organ or probe. A similar type of proboscis is found in the genus *Austroraptus*, where it is much more abruptly narrowed in the distal half.

The definition of the genus given by Hodgson and earlier writers requires considerable modification and enlargement. The chief characters of the genus are given below, followed by a key to the determination of the Antarctic and sub-Antarctic species.

Trunk rather compact, with distinct transverse body-ridges often greatly elevated in the centre; lateral processes in contact or separated by intervals up to their own diameter. Cephalon broad, neck very short or wanting; ocular tubercle situated a short distance behind the anterior border; eyes present.

Proboscis cylindrical, pyriform or gradually tapering distally (styliform).

Chelophore chelate in immature specimens, usually, but not always, with reduced chela in adult; scape single-jointed.

Palp eight- or nine-jointed.

Oviger ten-jointed, without terminal claw; sometimes an irregular series of special spines on the last four segments. In the male the seventh segment is very short, setose, and much wider than the three terminal segments.

Legs rather stout as a rule; second tibia usually the longest segment (the femur is longest in *A. gigantea*, the first tibia in *A. spinosa*); tarsus very short; propodus usually armed with a few stout spines on the proximal ventral margin; auxiliaries present. The genital apertures occur in the male on the two posterior pair of legs (on all four legs in *A. tetrapora*); in the female on all the legs.

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[1] This form is designated "styliform" in the key.

KEY TO THE DETERMINATION OF THE ANTARCTIC AND SUB-ANTARCTIC SPECIES OF *AMMOTHEA*

I. Chela large and perfect in the adult as well as in immature specimens [palp nine-jointed; transverse body ridges high; species of large size].

A. Proboscis sub-cylindrical, rather slender and much curved, equal to trunk; chela slightly longer than scape; palpal segments 2 and 4 subequal; second tibia the longest segment; no large spines on ventral margin of propodus ....*A. striata* (Möbius)

B. Proboscis straight, massive and somewhat pyriform, not quite three-fourths of trunk; chela half as long as scape; palpal segment 4 rather longer than 2; *femur* the longest segment; two spines on proximal ventral margin of propodus, the larger just over one-third of main claw ....*A. gigantea*, n.sp.

II. Chela large and perfect in immature specimens, imperfect and much reduced in adults.

A. Palp eight-jointed [transverse body ridges prominent, each rising in centre to an acutely conical process; two spines on proximal ventral margin of propodus; second tibia the longest segment].

I. Proboscis not quite two-thirds of trunk, bluntly conical; chelophore half as long as, palp rather longer than, proboscis; cephalic segment approximately equal to the sum of the three succeeding segments; larger spine on propodus scarcely half as long as main claw; male genital openings present on *all four legs*............*A. tetrapora*, n.sp.

[II. Proboscis slightly shorter than trunk, styliform; chelophore one-third of, palp rather shorter than, proboscis; larger spine on propodus half of main claw; cephalic segment equal to the sum of the two succeeding segments ....*A.* sp.? St. WS 216[1]]

III. Proboscis rather longer than trunk, styliform; chelophore scarcely one-third, palp not more than two-thirds, of proboscis; larger spine on propodus four-fifths of main claw; cephalic segment scarcely equal to the sum of the two succeeding segments ....*A. longispina*, n.sp.

B. Palp nine-jointed [and longer[2] than proboscis].

I. Transverse body ridges prominent, each, as a rule, rising in centre to at least the height of the ocular tubercle.

A. First tibia the longest segment; propodi of first and second markedly different from those of the third and fourth legs [claw almost two-thirds of propodus; proboscis scarcely as long as trunk, sub-cylindrical with a slight median constriction] ....*A. spinosa* (Hodgson)

B. Second tibia the longest segment; propodus similar for all four legs.

1. Palpal segments 5–8 serrated ventrally [segments 2 and 4 subequal; proboscis at least as long as trunk, pyriform; 4–6 small spines on proximal half of ventral margin of propodus] ....*A. minor* (Hodgson)
(*A. gracilipes*, Bouvier)

2. Palpal segments 5–8 cylindrical, not serrated ventrally.

a. Proboscis not exceeding three-fourths of trunk.

i. Proboscis sub-cylindrical; chelophore two-thirds of proboscis [palp longer than proboscis, segments 2 and 4 subequal; 3–4 spines on proximal half of ventral margin of propodus, the larger just over one-half of claw which is two-thirds of propodus] ....*A. calmani*, n.sp.
(*A. striata*? Calman)

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[1] This form is inserted here as the palp is apparently not quite normal and might prove to be eight-jointed.

[2] Palp not quite normal—may be longer or at least equal to proboscis in *A.* sp.? St. WS 216.

ii. Proboscis styliform; chelophore not exceeding one-third of proboscis [fourth palpal segment the longest].

α. Palp longer than proboscis and segment 4 almost twice as long as 2; two small proximal and one median spine on ventral margin of propodus; claw less than half of propodus; cephalic segment almost equal to the sum of the three succeeding segments *A. stylirostris*, n.sp.

β. Palp slightly shorter[1] than proboscis and segment 4 almost half as long again as 2; two proximal spines on ventral margin of propodus, the longer at least half of main claw which again exceeds half of the propodus; cephalic segment equal to the sum of the two succeeding segments ....*A.* sp.? St. WS 216

b. Proboscis equal to or longer than trunk [straight, pyriform or subcylindrical].

i. Palpal segment 2 almost half as long again as 4; numerous long, fine hairs on walking legs; chelophore at least half as long as proboscis with long slender scape ....*A. meridionalis*, Hodgson

ii. Palpal segment 4 equal to or longer than 2; setules but no hairs on walking legs; chelophore not exceeding one-fourth of proboscis in adults, scape short and stout [2–4 spines on proximal ventral margin of propodus, the longest not quite half of main claw].

α. Palpal segment 4 equal to, or rather longer than, 2 (1–1·45 : 1) *A. glacialis* (Hodgson)

β. Palpal segment 4 almost twice as long as 2 ......*A. carolinensis*, Leach[2] (*A. grandis*, Pfeffer) and *A. gibbosa*, Möbius

II. Transverse body ridges low, without median processes [proboscis longer than trunk, pyriform; chelophore not exceeding one-third of, palp longer than, proboscis; second tibia the longest segment; auxiliaries two-thirds of main claw, which is half of proboscis; species of small size].

A. Abdomen sub-vertical, in contact with posterior border of third segment; 3–4 small spines on proximal ventral margin of propodus, the longest rather more than one-third of main claw..*A. clausi*, Pfeffer

B. Abdomen oblique, separated by a short distance from posterior border of third segment; 5 small spines on proximal ventral margin of propodus, subequal and about one-fourth of main claw ....*A. australis*, Hodgson

Ammothea striata (Möbius) (Fig. 47 *b*).

Leionymphon striatum, Möbius, 1902, p. 183, pl. xxvi, figs. 7–12.

Ammothea striata, Bouvier, 1913, p. 124, figs. 75–77 (*nec A. striata*?, Calman, 1915, p. 55).

St. 167. 20. ii. 27. Off Signy Island, South Orkneys, 60° 50′ 30″ S, 46° 15′ W, 244–344 m.; gn. M. Large otter trawl: 1 ♂, largely overgrown with Polyzoa and *Alcyonidium*.

REMARKS. This species retains the chelate chelophore in the adult, as figured by Bouvier (1913, p. 125, fig. 75).[3] The scape is not quite half the length of the proboscis

[1] Palp not quite normal—may be longer or at least equal to proboscis in *A.* sp.? St. WS 216.

[2] There is very little difference between *A. carolinensis* and *A. gibbosa* (see Bouvier, 1913, pp. 123, 129 and Calman, 1915, p. 52). *A. clausi* and *A. australis* also are very similar; future investigations may result in uniting the two forms in either or both of these cases.

[3] See Calman, 1915, p. 56, on this point; the specimen is mature.

and 2·33 times as long as wide distally. The chela is slightly longer than the scape, the fingers curved and gaping when closed.

The proboscis is markedly curved and at least as long as the trunk if allowance is made for the curvature.

A. striata is most nearly related to *A. gigantea*, n.sp., which also retains the chelate chelophore in the adult. It is easily distinguished from the latter by (1) the rather slender curved proboscis; (2) the more massive chelophore, with chela even longer than the scape; (3) the absence of large spines on the propodus; and (4) the longer second tibia (see key, and table on p. 99).

Measurements (*mm.*)

Length of proboscis	15·0 +
Diameter of proboscis	2·5
Length of trunk	15·0
Length of cephalic segment	7·4
Width of cephalic lobes	6·7
Width across second lateral processes	13·3
Length of abdomen	4·0

Third leg:	
First coxa	2·7
Second coxa	8·0
Third coxa	3·0
Femur	26·6
First tibia	23·0
Second tibia	30·2
Tarsus and propodus ...	7·5
Claw	3·0
Auxiliaries	1·2

Distribution. South of Bouvet Island, South Shetlands and South Orkneys.

Ammothea gigantea, n.sp. (Figs. 46 and 47 *a*).

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 1 ovigerous ♂ (holotype); 1 ♂, overgrown with Polyzoa, Tunicates and Hydroids, 1 ♀.

Description of holotype. *Trunk* rather compact, lateral processes separated by narrow intervals—not exceeding half of their own diameter. Transverse body-ridges prominent, rising in the middle line above the level of the ocular tubercle to blunt, rounded apices. Cephalic segment equal to the sum of the two succeeding segments. Ocular tubercle small, scarcely higher than wide, tapering abruptly to a point above the level of the eyes which are of approximately equal size (Fig. 46).

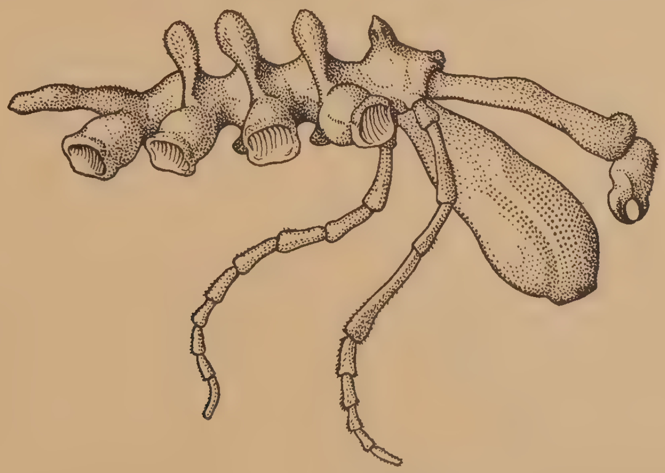

Fig. 46. *Ammothea gigantea*, n.sp. Lateral view of body with chelophore, palp and oviger: × 2.

Proboscis very robust, almost three-fourths of trunk; maximum width near the apex (Fig. 46).

Abdomen reaching a short distance beyond fourth lateral process, slightly elevated.

Chelophore very well developed in all three adult specimens, almost as long as proboscis. Scape long and rather stout, length approximately four times the distal width. Chela short and thick set, length of palm twice the width; fingers widely gaping when closed.

Palp nine-jointed[1] as in the majority of the species of *Ammothea*; fourth segment rather longer than second (1·24 : 1); segments 1–4 together as long as proboscis; terminal segments rather setose.

Ovigers each carrying a large mass of developing ova and larvae; segments 6–10 of the usual type; segments 2–4 subequal and each slightly shorter than segment 5.

Third leg long and stout; *femur the longest segment*; second coxa slightly longer than the sum of first and third. Terminal segments as represented in Fig. 47 *a* and similar in all four limbs.

Setules arranged in distinct longitudinal bands on the legs; they also occur on the abdomen, the transverse trunk ridges, lateral processes and chelophores.

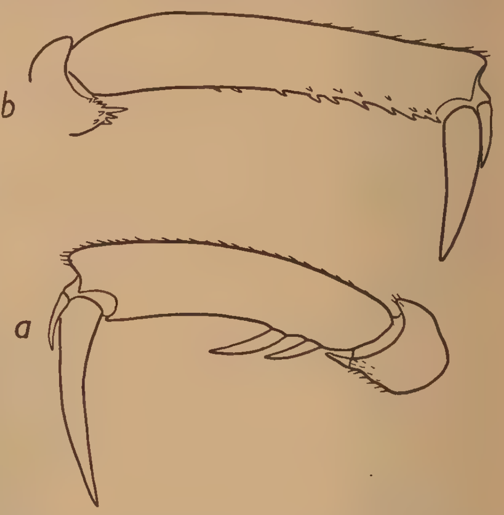

Fig. 47. Terminal segments of third leg of: *a. Ammothea gigantea*, n.sp.: ×6. *b. A. striata* (Möbius): ×8.

The *female* shows the usual sexual differences of oviger and walking legs; the femur is more robust, being scarcely more than seven times as long as wide as against nine times in the male. The setules are also fewer in number.

Measurements (mm.)

	♂ (holotype)	♀
Length of proboscis	16·7	19·2
Greatest width of proboscis	6·9	7·9
Length of trunk	21·8	23·0
Length of cephalic segment	9·2	10·4
Width of anterior cephalic lobes ...	7·8	7·8
Width across second lateral processes	18·9	19·2
Length of abdomen	6·9	7·3
Third leg:		
First coxa	5·0	4·4
Second coxa	10·6	11·0
Third coxa	4·2	5·4
Femur	34·0	41·2
First tibia	29·4	32·6
Second tibia	32·3	36·8
Tarsus and propodus	8·8	9·2
Claw	5·3	5·3
Auxiliaries	1·5	1·6

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[1] Measurements of segments of palp: 2·4; 5·8; 3·5; 7·2; 2·4; 2·4; 2; 1·8; 2·4 mm.

REMARKS. This species is the largest that has been described up to the present.

It is most closely allied to *Ammothea striata*, Möbius; in both forms the chelophore is large and the chela is perfect right up to the adult condition. The chief differences between the two species are listed in the following table.

Ammothea striata	*Ammothea gigantea*
Proboscis long, slender, curved; 6 times as long as wide and as long as trunk	Proboscis stout, straight, 2½ times as long as wide and not exceeding four-fifths of trunk
Scape subequal to chela and less than half of proboscis	Scape twice as long as chela and three-fourths of proboscis
Second tibia the longest segment	Femur the longest segment
No large spines on proximal ventral margin of propodus, which is at least twice as long as claw	Two spines on proximal ventral margin of propodus which is only half as long again as claw

Ammothea tetrapora, n.sp. (Figs. 48, 49 and 50*a*).

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Island, from 7 miles N 50° E to 7·6 miles N 63° E of Eddystone Rock, 105–115 m.; f. S. Large otter trawl: 2 ♂♂, 2 ♀♀.

St. WS 244. 18. vii. 28. 52° 00′ S, 62° 40′ W, 253–247 m.; f. d. S. M. Commercial otter trawl: 1 larvigerous ♂ (holotype), 1 ♀.

DESCRIPTION OF HOLOTYPE. *Trunk* compact, lateral processes in contact or separated by very narrow intervals proximally. Transverse body ridges prominent, each with a high, narrow, conical median projection. Cephalic segment considerably expanded anteriorly, not quite as long as the sum of the three posterior segments. Ocular tubercle stout, scarcely higher than wide, tapering to a point above the level of the eyes; anterior much larger than the posterior eyes (Fig. 48).

Proboscis straight; directed obliquely downwards; widest at the base, then sub-cylindrical, narrowing distally to a blunt rounded apex; slightly more than half as long as trunk.[1]

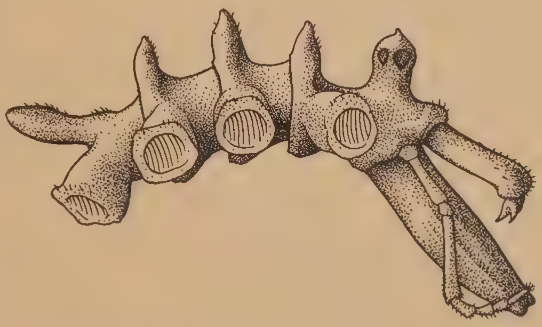

Fig. 48. *Ammothea tetrapora*, n.sp. Female. Lateral view of body with chelophore and palp: × 6.

Abdomen elevated at an angle of about 45° and reaching to distal end of fourth lateral process.

Chelophore. Scape short, club-shaped; distal width half the length. Chela small; fingers reduced and no longer capable of meeting distally.

Palp with only eight segments in all specimens; second approximately two-thirds of fourth segment. The reduction in the number of segments may be due to fusion of

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[1] Measured dorsally.

the fourth and fifth joints (Fig. 49 *b*), as the longest segment sometimes has a slight constriction near the distal end but never any trace of a suture.

Oviger. The ovigers are hidden almost completely by the two clusters of larvae; one from another male is represented in Fig. 49 *a*.

Third leg. Second coxa rather longer than the sum of the first and third. Femur subequal to first and a little shorter than second tibia; approximately six times as long as wide. Terminal segments as represented in Fig. 49 *a*; similar in all four legs. Setules restricted almost entirely to the dorsal surface of the longer segments, with a single row on each lateral and ventral surface. The genital openings are present on the second coxae of *all four* legs.

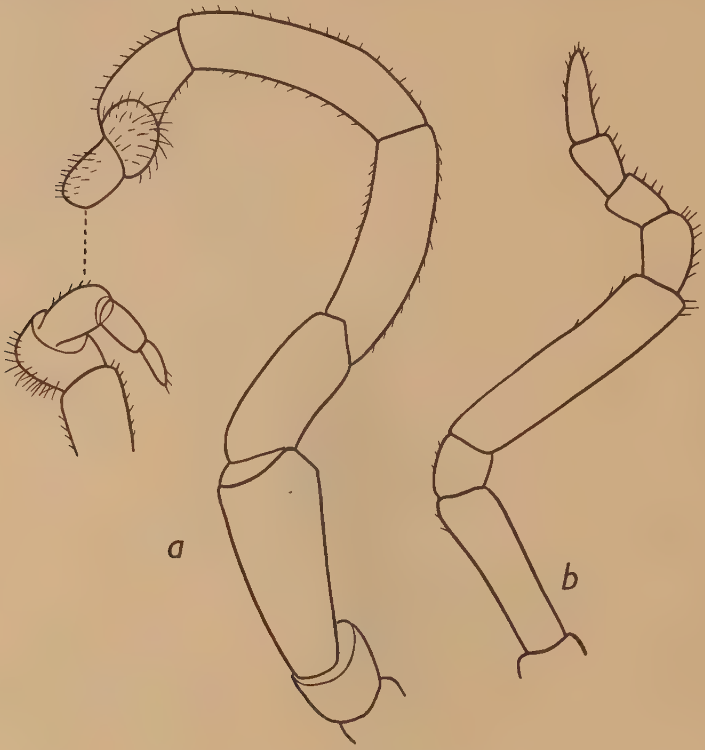

Fig. 49. *Ammothea tetrapora*, n.sp.: *a*. Oviger of male. *b*. Palp. (Both × 20.)

The *female*, apart from the usual sexual differences, agrees with the male. The femur is only four times as long as wide.

Remarks. The smaller specimens from St. 51 (measuring 6–6·8 mm. in length) all have conspicuous genital openings, but the fingers of the chelae are rather longer than in the holotype and the legs are relatively shorter and stouter. There are four pairs of genital openings in each male specimen; in the other species of *Ammothea* the genital openings are only present on the second coxa of the last two pairs of legs.

This species agrees with *A. longispina*, n.sp., in the number of palpal segments, but it is a smaller form with a shorter, more cylindrical proboscis, a longer palp and much shorter spines on the propodus (see key).

Measurements (mm.)

	♂ (holotype)	♂ (St. 51)	♀ (St. WS 244)
Length of proboscis	4·8	3·6	4·8
Proximal width of proboscis ...	2·0	2·0	2·0
Length of trunk	8·0	6·8	8·0
Length of cephalic segment ...	3·6	3·4	4·0
Width of anterior cephalic lobes ...	2·2	2·43	2·4
Width across second lateral processes	7·47	6·0	6·8
Length of abdomen	2·8	2·0	2·75
Length of scape	2·1	1·8	2·2
Greatest width of scape	1·0	0·9	1·0
Third leg:			
First coxa	1·6	1·47	1·6
Second coxa	3·3	2·5	3·2
Third coxa	0·8	1·0	1·0
Femur	9·4	6·4	9·2
First tibia	9·4	6·4	8·8
Second tibia	10·2	6·8	10·0
Tarsus and propodus	3·2	2·75	3·2
Claw	1·5	1·2	1·33
Auxiliaries	0·6	0·53	0·5

Ammothea longispina, n.sp. (Figs. 50 *b*, 51 and 52).

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 1 ♀ (holotype).

Description of holotype. *Trunk* rather compact; lateral processes separated by narrow intervals, last two pairs by almost their own diameter. Transverse body ridges prominent, each with a narrow, conical median projection. Cephalic segment with a blunt rounded lobe external to the insertion of each chelophore; hardly as long as the sum of the two succeeding segments. Ocular tubercle rather higher than wide, stout, rounded at apex; eyes set near apex, of small size but the anterior rather larger than the posterior pair (Fig. 51).

Proboscis longer than trunk, straight, slender; widest in proximal third narrowing to almost half this width anteriorly; apparently suited for probing.

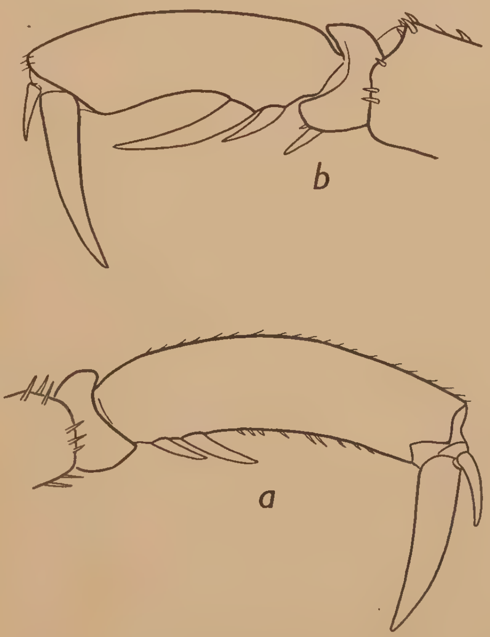

Fig. 50. Terminal segments of third leg of: *a. Ammothea tetrapora*, n.sp. *b. A. longispina*, n.sp. (Both × 20.)

Abdomen rather long but much elevated, so that it does not reach beyond the distal end of the fourth lateral process.

Chelophore almost one-third of proboscis; scape twice as long as wide distally; chela small, fingers almost obsolete.

Palp much shorter than proboscis, with only eight segments; second subequal to fourth segment (Figs. 51 and 52 *a*).

Oviger as represented in Fig. 52 *b*.

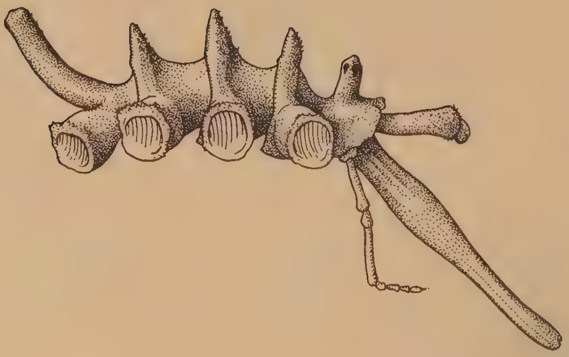

Fig. 51. *Ammothea longispina*, n.sp. Holotype. Lateral view of body with chelophore and palp: × 3.

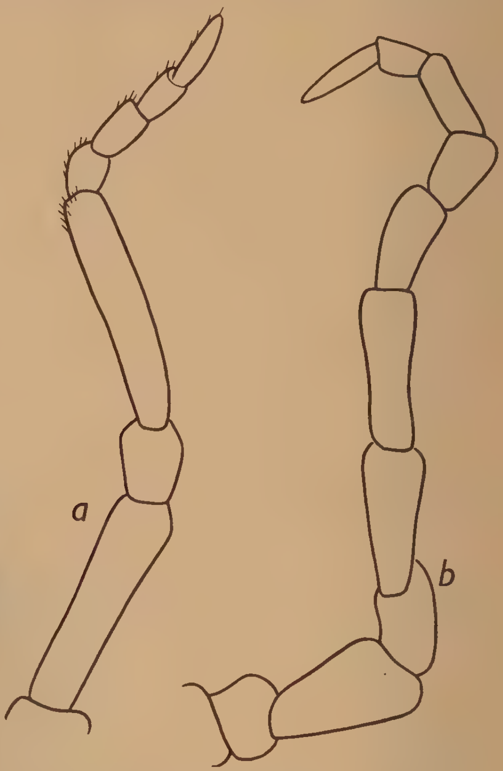

Fig. 52. *Ammothea longispina*, n.sp. Holotype: *a*. Palp: ×15. *b*. Oviger: ×11.

Third leg rather short and stout. Second coxa approximately equal to the sum of the first and third. Femur five times as long as wide, slightly shorter than second tibia. Terminal segments as represented in Fig. 50 *b*; distal spine on propodus unusually large, the smaller spine wanting on the propodus of the first leg.

Setules on trunk restricted to the conical processes of each transverse ridge, the two low cephalic protuberances and the distal border of each lateral process. On the legs they are arranged in longitudinal rows on the longer segments; on the dorsal border of each tibia they are replaced by small, curved spines.

Measurements (mm.)

		Third leg:	
Length of proboscis	13·3	First coxa	2·8
Greatest width of proboscis	2·4	Second coxa	4·6
Length of trunk	11·6	Third coxa	2·0
Length of cephalic segment	4·9	Femur	14·0
Width of anterior border of cephalon	3·9	First tibia	12·2
Width across second lateral processes	10·0	Second tibia	15·0
Length of abdomen	5·6	Tarsus and propodus ...	4·8
Length of chelophore	4·0	Claw	2·8
		Auxiliaries	0·8

Remarks. Each palp seems to be quite perfect and there is no distinct evidence of fusion of any two segments. This species is much larger than *A. tetrapora* and is characterized by (1) the long, tapering proboscis, (2) the relatively short palp (in *A. tetrapora* the palp is longer than the proboscis), (3) the very large spine on the propodus, and (4) the blunt antero-lateral cephalic lobes.

Ammothea spinosa (Hodgson) (Fig. 53).

Leionymphon spinosum, Hodgson, 1907, p. 49, pl. vii, fig. 2.
Ammothea spinosa, Bouvier, 1913, p. 123 (in key).
Ammothea spinosa, Calman, 1915, p. 52.

St. WS 215. 31. v. 28. 47° 37′ S, 60° 50′ W, 219–146 m.; f. gn. S. Commercial otter trawl: 1 ♂.

St. WS 245. 18. vii. 28. 52° 36′ S, 63° 40′ W, 304–290 m.; d. gn. S. Sh. Commercial otter trawl: 1 ovigerous ♂.

Remarks. There can be no doubt that these two specimens belong to *A. spinosa* although they are more compactly built, with much smaller non-recurved "tubercular processes" on each lateral process, than in the holotype. Also the fine, silky hairs on body and legs are very sparse.

One of the most outstanding characteristics of the species, namely the variation in the terminal segments of the walking legs, has not been adequately described by Hodgson (1907, p. 50). In all specimens examined the two anterior pairs of legs each have the propodus relatively short and stout, with numerous spines on the ventral margin arranged in the manner represented in Fig. 53 *a*. The propodus of the third or fourth leg, on the other hand, is relatively slender with 6–7 small spines on the proximal half of the ventral margin and none on the distal half (Fig. 53 *b*). The first tibia is longer than the second. In these two respects *A. spinosa* differs from all the other Antarctic species of the genus.

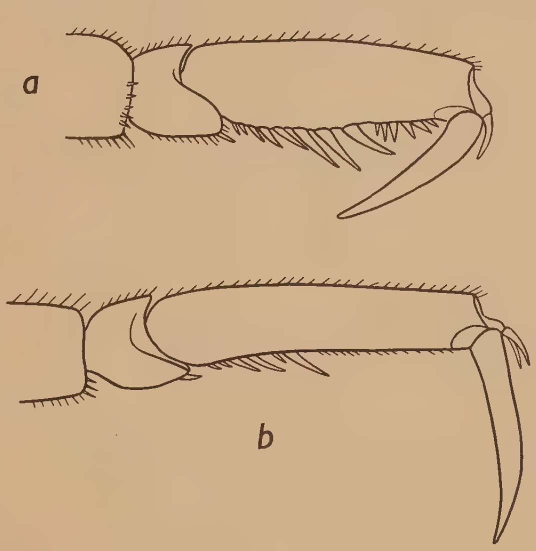

Fig. 53. *Ammothea spinosa* (Hodgson). Holotype: terminal segments of *a*, first leg; *b*, fourth leg: ×15.

Distribution. Ross Sea and Magellan District.

Ammothea minor (Hodgson).

Leionymphon minus, Hodgson, 1907, p. 44, pl. vi, fig. 2.
Ammothea minor, Bouvier, 1913, pp. 123, 131, figs. 83, 84.
Ammothea gracilipes, Bouvier, 1913, p. 132, figs. 85–87.
Ammothea minor, Calman, 1915, p. 52.
Ammothea (*Leonymphon*) *minor*, Loman, 1923, p. 23.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia; 3·3 miles S 44° E of Jason Light, 110 m.; M. R. Large dredge: 1 ♂.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m.; M. Large otter trawl: 1 immature specimen.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point, to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 1 immature specimen.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 64° 56′ S, 65° 35′ W, 93–130 m.; St. M. R. Large dredge: 1 ♀ with a few Foraminifera and Polyzoa on legs.

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 1 immature specimen bearing some Polyzoa and Foraminifera.

REMARKS. The specimens agree well with Bouvier's description of *A. gracilipes*.

DISTRIBUTION. This species is recorded from both sides of the Antarctic—the Ross Sea and the region around South Georgia.

Ammothea calmani, n.sp. (Figs. 54 and 55).

A. striata?, Calman, 1915, p. 55.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W, 160–335 m.; m. St. Large otter trawl: 1 immature specimen with large chelophores.

This immature specimen belongs to the same species as the large male referred, with considerable doubt, to *A. striata* by Calman (1915, p. 55). The adult specimen may be regarded as the holotype.

DESCRIPTION OF IMMATURE SPECIMEN. *Trunk* with second to fourth lateral processes separated by their own diameter. Transverse body ridges prominent but not greatly elevated in the middle line. Cephalic segment equal to the sum of the two succeeding segments. Ocular tubercle a little higher than wide, apex bluntly pointed and on a level with the median transverse ridge. Anterior very much larger than the posterior pair of eyes (Fig. 54).

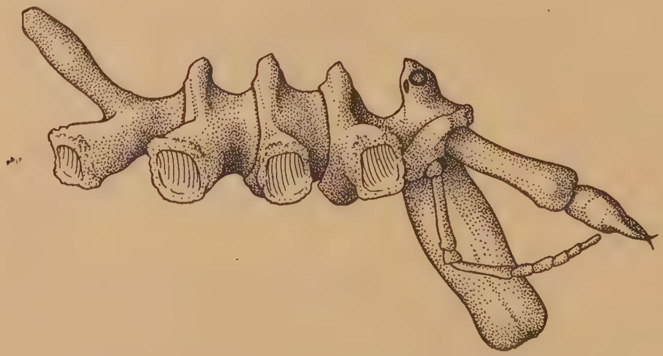

Fig. 54. *Ammothea calmani*, n.sp. Young specimen. Lateral view of body with chelophore and palp: × 5.

Proboscis short, sub-cylindrical; length almost three times the width and approximately equal to the sum of the two anterior segments of trunk.

Abdomen elevated at an angle of about 45°, reaching a little beyond fourth lateral process.

Chelophore slightly longer than proboscis; scape longer than chela and rather slender (length 2·5 times the distal width).

Palp considerably longer than proboscis, with nine segments, of which the second and fourth are subequal (Fig. 55 *a*).

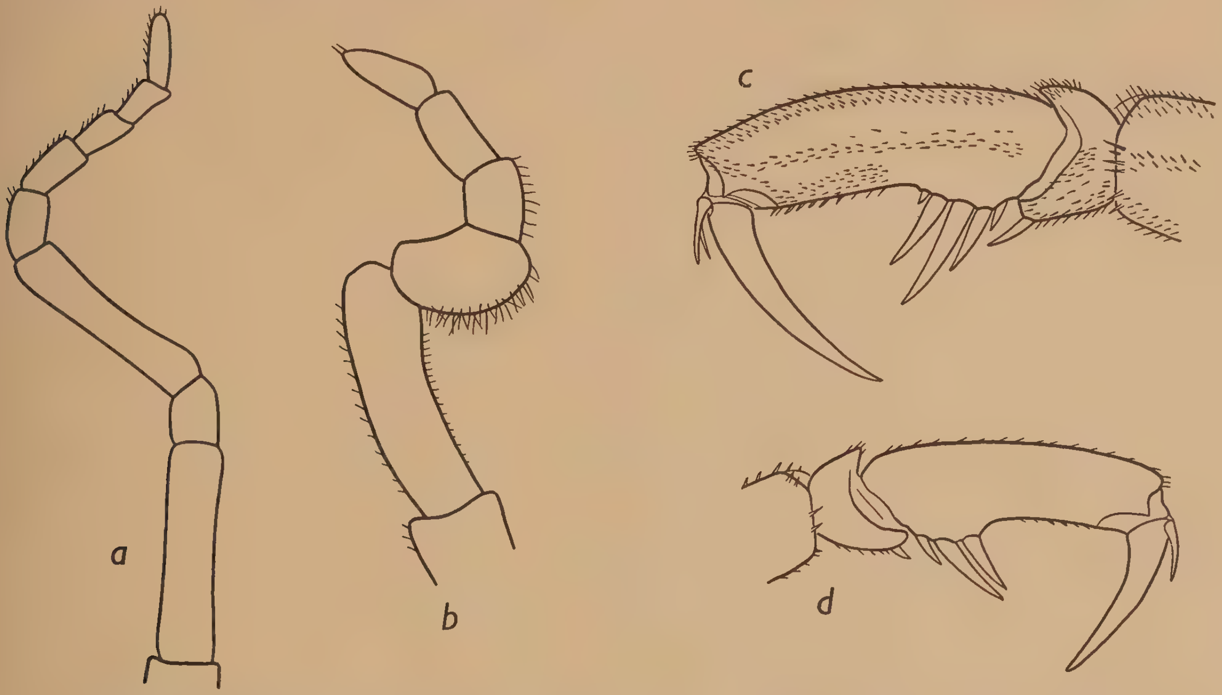

Fig. 55. *Ammothea calmani*, n.sp.: *a*. Palp of young specimen. *b*. Terminal segments of oviger of holotype. *c*. Terminal segments of third leg of holotype. *d*. Same of young specimen. (*a* and *b*: ×15; *c* and *d*: ×10.)

Oviger small but with all ten segments distinct.

Third leg rather slender; femur 5·5 times as long as wide; second tibia the longest segment. Propodus with two large and one small spine on the proximal ventral margin (Fig. 55 *d*); the terminal segments are very similar in all four legs.

Measurements (*mm.*)

		Third leg:	
Length of proboscis	5·8	First coxa	1·8
Width of proboscis	2·2	Second coxa	4·0
Length of trunk	10·5	Third coxa	1·8
Length of cephalic segment	4·2	Femur	11·0
Width of anterior border of cephalon	3·1	First tibia	10·7
Width across second lateral processes	7·9	Second tibia	12·0
Length of abdomen	3·6	Tarsus and propodus	5·0
Length of scape	4·0	Claw	2·4
Length of chela	3·0	Auxiliaries	0·8

Remarks. The adult male is not in a sufficiently good condition to give accurate measurements. It agrees with the immature specimen in most respects. The transverse body ridges on the second and third segments are more massive and are higher than the ocular tubercle. The chela is greatly reduced so that the chelophore is shorter than the proboscis. A fourth spine is present on the propodus of each walking leg (Fig. 55 *c*) and the setules are arranged in distinct longitudinal bands on the three long segments. Segments 2–6 of the oviger measure 4·4, 3·6, 4·0, 4·4 and 2·5 mm. respectively; the terminal segments are represented in Fig. 55 *b*. The right palp is slightly abnormal near the tip; segments 7 and 8 seem to be fused together.

This species appears to be related to *A. stylirostris*, from which it can easily be distinguished by (1) the shape of the proboscis, (2) the longer claw and much larger spines on the propodus, (3) the larger chelophore, and (4) the much shorter fourth palpal segment.

Distribution. Palmer Archipelago and off Oates Land.

Ammothea stylirostris, n.sp. (Figs. 56 and 57).

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock, 179–235 m.; gy. M. Large otter trawl: 1 ♀ (holotype) and 1 immature specimen with well-developed chelae.

Description of holotype. *Trunk* of rather compact build; intervals between lateral processes increasing posteriorly. Transverse body ridges rather prominent, each rising in the centre to a low, rounded point. Cephalic segment nearly as long as the sum of the three posterior segments, considerably expanded on a level with the ocular tubercle; a low rounded lobe projecting over the base of each scape. Ocular tubercle almost half as high again as wide, tapering abruptly to a point distally. Anterior twice as large as the posterior pair of eyes (Fig. 56).

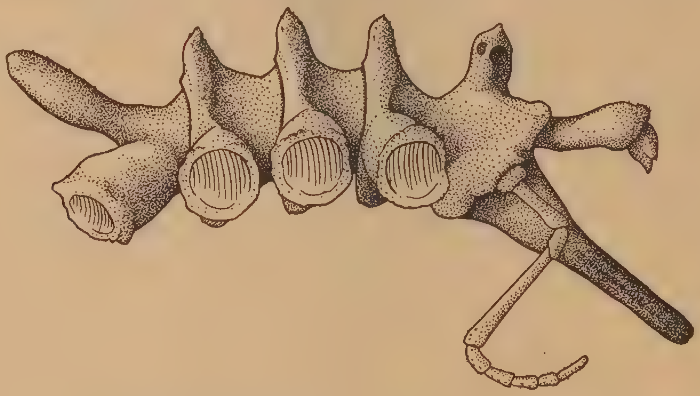

Fig. 56. *Ammothea stylirostris*, n.sp. Holotype. Lateral view of body with chelophore and palp: × 5.

Proboscis approximately two-thirds as long as trunk, straight, widest at base, which is surrounded by a prominent collar, and gradually narrowing distally; presumably adapted for probing.

Abdomen elevated at an angle of about 45° and reaching to distal end of fourth lateral process.

Chelophore short, less than one-third of proboscis; scape short, clubbed; chela small, with fingers reduced to small blunt stumps.

Palp rather longer than proboscis, with nine segments (Fig. 57 *b*); fourth almost twice as long as second segment.

Oviger as represented in Fig. 57 *a*.

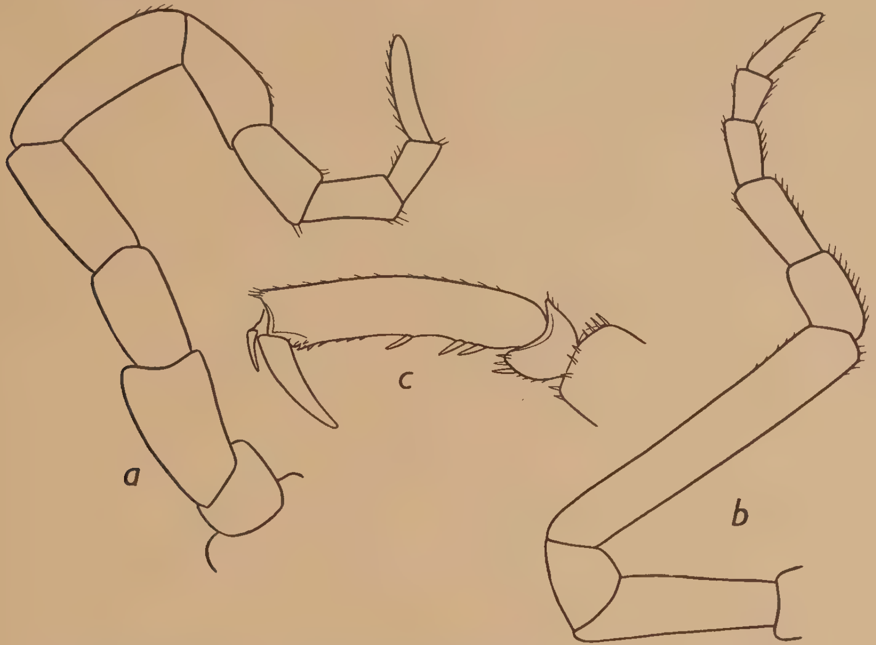

Fig. 57. *Ammothea stylirostris*, n.sp. Holotype: *a*. Oviger: ×15. *b*. Palp: ×15. *c*. Terminal segments of third leg: ×11.

Third leg relatively short and stout. Second coxa equal to the sum of the first and third. Femur almost five times as long as wide; second tibia the longest segment; terminal segments as represented in Fig. 57 *c*. Setules arranged in longitudinal rows on the longer segments.

Measurements (*mm*.)

		Third leg:	
Length of proboscis	7·8	First coxa	2·27
Basal width of proboscis	3·6	Second coxa	4·0
Length of trunk	11·2	Third coxa	1·73
Length of cephalic segment	5·4	Femur	11·2
Greatest width of cephalon	4·6	First tibia	10·6
Width of anterior border of cephalon	3·4	Second tibia	12·8
Width across second lateral processes	8·4	Tarsus and propodus	4·6
Length of abdomen	3·6	Claw	1·8
Length of chelophore	2·2	Auxiliaries	0·75

REMARKS. The immature specimen measures 8·5 mm. in length (trunk only) and is very soft; the chelophores are half as long as the trunk, with perfect chelae.

The proboscis is rather similar to that of *A. longispina*, n.sp., but is only two-thirds as long as the trunk; the palp, moreover, has nine instead of eight segments; the spines on the ventral margin of the propodus are much smaller and the claw is much shorter.

The specimen described as *Ammothea*, sp.? (WS 216) is nearly related to this species; but one palp is undergoing regeneration distally and the other does not appear to be quite normal as regards the terminal segments (Fig. 58 *b*). The differences between the two forms are given in the key.

Ammothea, sp.? (Fig. 58).

St. WS 216. 1. vi. 28. 47° 37′ S, 60° 50′ W, 219–133 m.; f. S. Commercial otter trawl: 1 ♀.

The single female specimen bears a strong superficial resemblance to the holotype of *Ammothea longispina* but is of much smaller size. The proboscis is of the same type, although it is not quite as long as the trunk. The right palp has nine segments[1] and the fourth is distinctly longer than the second segment. Unfortunately the left palp has been damaged and the tip is undergoing regeneration; the sixth segment is about to bifurcate and a seventh segment is present on the inner antero-lateral angle. There are no prominent rounded lobes on the anterior margin of the cephalon and the anterior spine on the propodus is much shorter than in *A. longispina* (Fig. 58 *c*, cf. Fig. 50 *b*). The oviger is represented in Fig. 58 *a*.

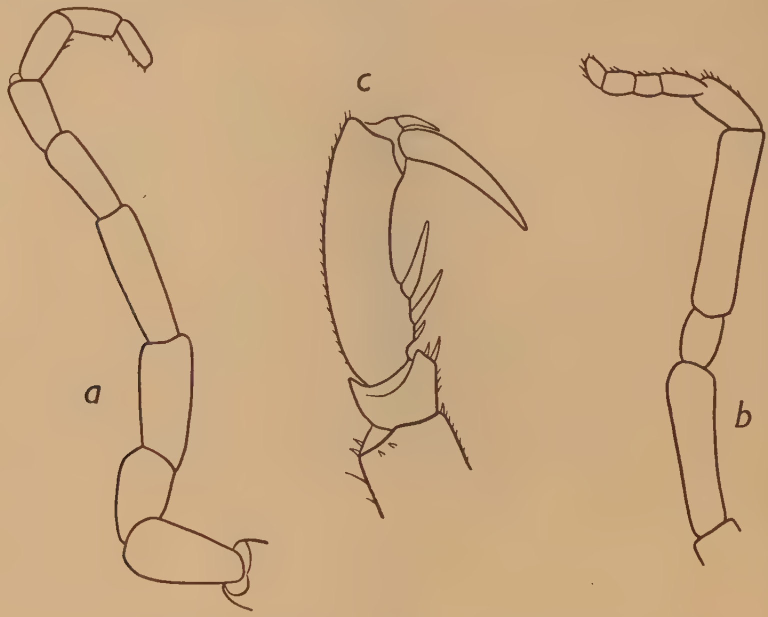

Fig. 58. *Ammothea*, sp.? St. WS 216: *a*. Oviger: ×15. *b*. Right palp: ×15. *c*. Terminal segments of third leg: ×11.

The specimen appears to be mature, for the genital apertures are large and conspicuous. If the palp is normally nine-jointed this species would not be the same as *A. stylirostris*. According to Bouvier's key it is nearest to *A. glacialis* (Hodgson), but the proboscis is strikingly different in the two forms.

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[1] The terminal segments of this palp also may have been regenerated (see Fig. 58 *b*).

Measurements (*mm.*)

Length of proboscis	6·8
Basal width of proboscis	2·0
Length of trunk	7·6
Length of cephalic segment	3·2
Width of anterior border of cephalon	2·53
Width across second lateral processes	6·4
Length of abdomen	3·07
Length of chelophore	2·2

Third leg:	
First coxa	1·4
Second coxa	3·2
Third coxa	1·2
Femur	9·8
First tibia	8·2
Second tibia	10·0
Tarsus and propodus ...	3·2
Claw	1·55
Auxiliaries	0·6

Ammothea carolinensis, Leach (= *Ammothea grandis*, Pfeffer).

A. carolinensis, Calman, 1915 *a*, pp. 310–314, text-figs. 1–3 (references on p. 314, that of Hodgson, 1907, excepted); 1915, p. 52.
Leionymphon grande, Hodgson, 1908, p. 179.

St. 141. 29. xii. 26. East Cumberland Bay, South Georgia, 200 yards from shore, under Mount Duse, 17–27 m.; M. Small beam trawl: 1 immature specimen.

St. 145. 7. i. 27. Stromness Harbour, South Georgia, between Grass Island and Tonsberg Point, 26–35 m. Small beam trawl: 1 ovigerous ♂.

S.S. Carl. 1. iv. 25. Brought up on anchor in Maiviken, South Georgia: 1 specimen, soft, probably a slightly immature ♀.

Sappho Pt. 2. iv. 26. Grytviken, South Georgia, washed up on beach: 1 ♀, overgrown with Polyzoa.

Shore Collection. 25. ii. 26. Cumberland Bay, South Georgia, near Green Point: 1 ♀, overgrown with Polyzoa on proboscis and legs.

DISTRIBUTION. Western Antarctic—South Georgia and farther south.

Ammothea clausi, Pfeffer.

Bouvier, 1913, p. 135, text-figs. 88, 89 (for references and synonymy).
Loman, 1923, p. 23.

St. 141. 29. xii. 26. East Cumberland Bay, South Georgia, 200 yards from shore, under Mount Duse, 17–27 m.; M. Small beam trawl: 1 ♀.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W, 342 m.; R. Large dredge: 2 ♀♀.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ S, 58° 28′ 30″ W, 391 m.; M. St. Medium otter trawl: 3 ♀♀ (one with 4 egg capsules (?) attached to proboscis), 2 immature specimens.

WS 25. 17. xii. 26. Undine Harbour (North), South Georgia, 18–27 m.; M. S. Small beam trawl: 2 ♀♀.

WS 62. 19. i. 27. Wilson Harbour, South Georgia, 15–45 m. Small beam trawl: 1 ♀.

MS 62. 24. ii. 26. East Cumberland Bay, ½ cable E to 3¾ cables S of Hobart Rock, 31–40 m. Small beam trawl: 1 ♀.

MS 67. 28. ii. 26. East Cumberland Bay, 3 cables NE of Hobart Rock to ½ cable W of Hope Point, 38 m. Small beam trawl: 1 immature specimen.

MS 68. 2. iii. 26. East Cumberland Bay, 1·7 miles S ½ E to 8½ cables SE × E of Sappho Point, 220–247 m. Large rectangular net: 2 ♀♀, 1 ♂.

Shore Collection. 2. iv. 26. South Georgia, Grytviken, Sappho Point, 1 ♀, washed up on shore.

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 1 specimen.

REMARKS. It is possible that *Ammothea australis* may prove to be only an eastern form of *A. clausi*. At any rate the differences between the two are very slight.

Genus Achelia, Hodge

Hodge, 1864, p. 114.
Bouvier, 1913, p. 122 (in key), pp. 138–140.
Calman, 1915, p. 56.
Loman, 1923, p. 24.

This genus differs from *Ammothea* in (1) the much smaller size of the species, (2) the absence of transverse body ridges, and (3) in the type of the male oviger (cf. Figs. 49 *a*, 55 *b* and 59 *a* and *b*). The tubercles that bear the male genital openings and the openings of the femoral cement glands are not always very prominent (e.g. in *A. hoekii*, Fig. 60 *a*).

Achelia hoekii (Pfeffer)

(Figs. 59 *a*, *b* and 60 *a*, *c*).

Ammothea Hoekii, Pfeffer, 1889, *Jahrb. Hamburg. Wiss. Anst.*, VI, Heft 2, p. 46.
? *Ammothea* (*Achelia*) *Hoekii*, Loman, 1923, p. 24.

St. 174. 28. ii.–1. iii. 27. Deception Island, South Shetlands, outside entrance, W of Light, 5–10 m. Large fish trap: 2 ♀♀, 1 ♂.

DESCRIPTION. *Trunk* compact, lateral processes in contact; sutures between the segments distinct in two specimens—the last suture is rather faint in one female. Cephalic segment subequal to the sum of the three posterior segments; cephalon broad; ocular tubercle wider than high, bluntly rounded distally.

Proboscis equal to trunk, widest in the middle and bluntly conical both proximally and distally.

Abdomen rather short, reaching to distal end of first coxa.

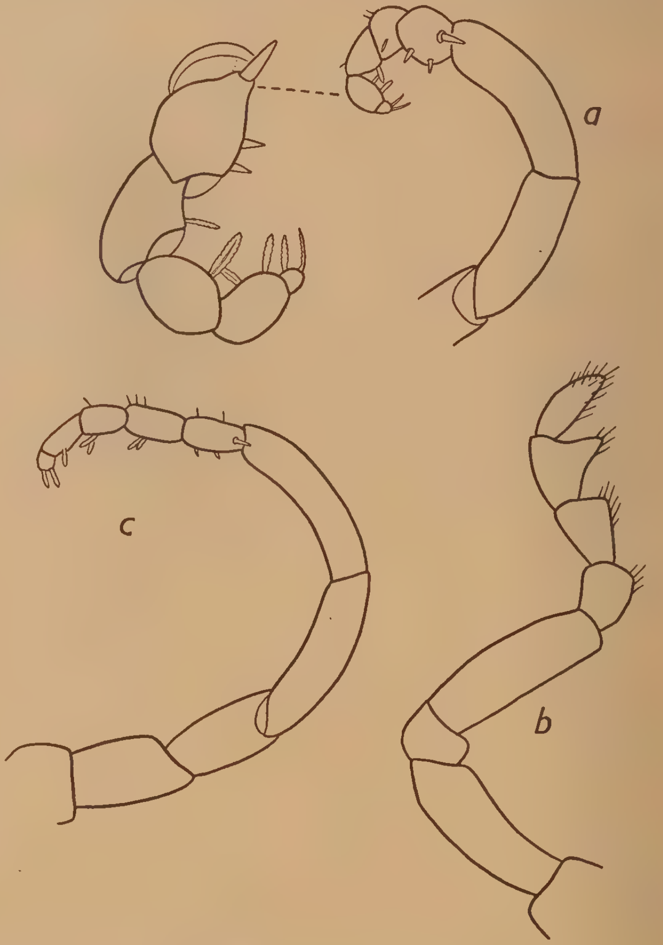

Fig. 59. *Achelia hoekii* (Pfeffer): *a*. Segments 4–10 of male oviger: ×47 and terminal segments still further enlarged. *b*. Palp of male: × 60. *A. communis*, Bouvier. *c*. Oviger of male: × 60.

Chelophore scarcely half of proboscis; scape twice as long as the greatly reduced chela.

Palp with the terminal segments distinctly serratiform ventrally in the male (Fig. 59 *b*), rather less so in the female; segments 2 and 4 subequal.

Oviger in the male relatively more robust than that of *Achelia communis*, with the terminal segments much more twisted (cf. Fig. 59 *a* and *c*). The prominent spine near the proximal articulation of segment 6 is very characteristic (Fig. 59 *a*).

Third leg of male as represented in Fig. 60 *a*; the male genital opening is situated on a much lower tubercle than in *A. communis* and there is no prominent cement gland-tubercle at the distal end of the femur (cf. Fig. 60 *a* with Bouvier, 1906, p. 48, fig. 32).

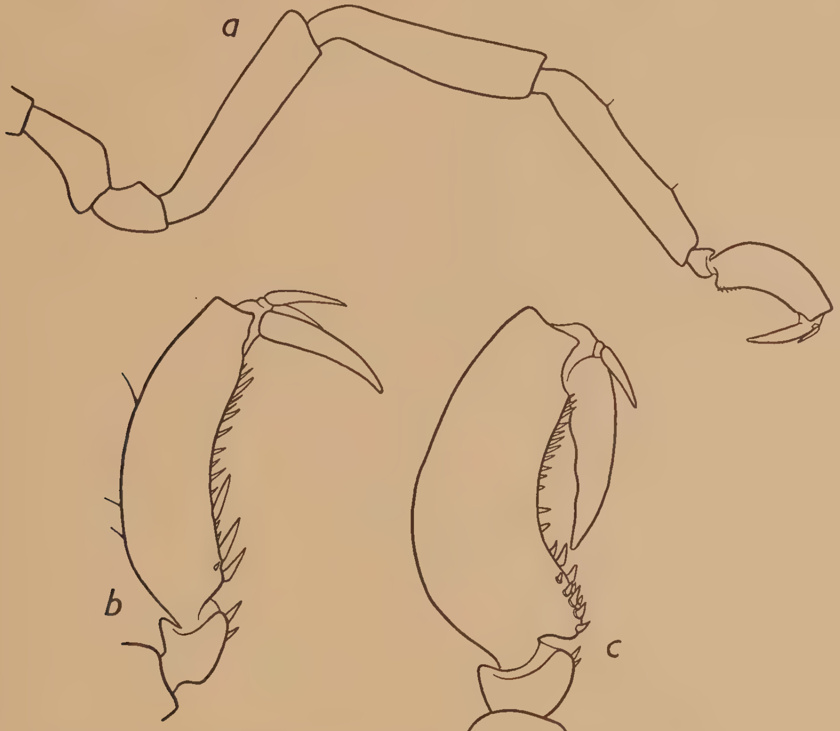

Fig. 60. *Achelia hoekii* (Pfeffer): *a*. Third leg of male: × 20. *c*. Terminal segments of third leg: × 53.
A. communis Bouvier: *b*. Terminal segments of third leg: × 60.

The propodus is higher and more arched, with a distinct heel beset with a number of short stout spines (cf. Fig. 60 *b* and *c*). There are no prominent conical tubercles on the first coxae in the female, and just a hint of them in the male.

Remarks. The co-types of *Achelia hoekii* were examined in the Zoological Museum, Hamburg. The Discovery specimens agree in all respects with sketches made of a male and of a female co-type. Loman (1923, p. 24) states that *A. communis*, Bouvier, is co-specific with *A. hoekii*. Specimens of the former, presented by Professor Bouvier to the British Museum, differ in several respects from the types of *A. hoekii*. The differences (described and figured above) in (1) oviger, (2) walking legs, seem to justify the separation of *A. communis* from *A. hoekii*. In the latter the palp is more serrated distally and the antero-lateral processes on the cephalon are absent.

DISTRIBUTION. South Georgia and South Shetlands.

Achelia intermedia, Calman (Fig. 61).

Calman, 1915, p. 60, fig. 15 A–C.

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 6 ♀♀, 1 ♂, with *A. brucei*.

? St. WS 27. 19. xii. 26. 53° 55′ S, 38° 01′ W, 107 m. 1 m. horizontal tow-net—net touched bottom: 1 ♀.

REMARKS. The specimens from St. 371 agree in most respects with the Terra Nova specimens of *Achelia intermedia*. The walking legs, however, are relatively longer and more slender (see Fig. 61 *a* and *b*, and the ratios given below).

	Terra Nova		Discovery	
	♂	♀	♂	♀
Femur: length ÷ maximum width	4·5	3·3	5·75	4·75
First tibia: length ÷ maximum width	5·0	4·75	6·25	7·0
Second tibia: length ÷ maximum width	6·83	6·66	8·89	9·5

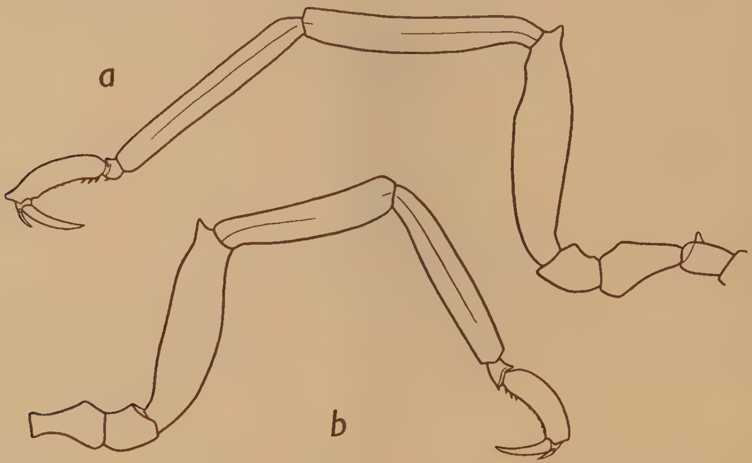

Fig. 61. *Achelia intermedia*, Calman: *a*. Third leg of female—Discovery collection. *b*. Same—Terra Nova collection. (Both ×13.)

The specimen from WS 27 is rather different from all the others. The chelophore is longer, exceeding the second palpal segment, but is not quite half of the proboscis—in this respect the specimen approaches *Achelia spicata*, Hodgson (Calman, 1915, p. 57). On the other hand the main claw is relatively shorter and only twice as long as the auxiliaries—in this respect the specimen approaches *Achelia brucei*. The ocular tubercle, however, is longer than wide, terminating in a long acute point. This specimen is another aberrant or "abnormal" form, agreeing with the species in group *a* of Calman's key in most respects, but approaching those in group *b* as regards the auxiliary claws of the walking legs (Calman, 1915, p. 57).

DISTRIBUTION. Previously recorded from off Cape Adare.

Achelia brucei, Calman.

Calman, 1915, p. 61, fig. 16 A–C.

St. 141. 29. xii. 26. East Cumberland Bay, South Georgia, 200 yards from shore, under Mount Duse, 17–27 m.; M. Small beam trawl: 1 ♀.

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 4 ♀♀ with *A. intermedia*.

DISTRIBUTION. Previously recorded from off Cape Adare.

Achelia serratipalpis, Bouvier.

Bouvier, 1913, p. 140, figs. 90–95.
Loman, 1923, p. 25.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ S, 58° 28′ 30″ W, 391 m.; M. St. Medium otter trawl: 2 ♀♀, 5 ♂♂ (3 ovigerous), with *Nymphon charcoti*.

? St. 274. 4. viii. 27. Off St Paul de Loanda, Angola, from 8° 40′ 15″ S, 13° 13′ 45″ E to 8° 38′ 15″ S, 13° 13′ E, 64–65 m.; gy. M. Large otter trawl: 1 incomplete ♀.

DISTRIBUTION. The incomplete female specimen from St. 274 undoubtedly belongs to this well-defined species, which has been recorded only from Antarctic waters. There appears to be little but the exoskeleton in this instance and it is probable that the specimen was captured in the Antarctic but may have been left entangled in the net for some time. At any rate, the material is not sufficient to warrant the supposition that *A. serratipalpis* extends from Graham Land, the South Shetlands and South Georgia northwards into tropical waters.

Achelia parvula, Loman (Fig. 62).

Loman, 1923 *a*, p. 2, fig. A.

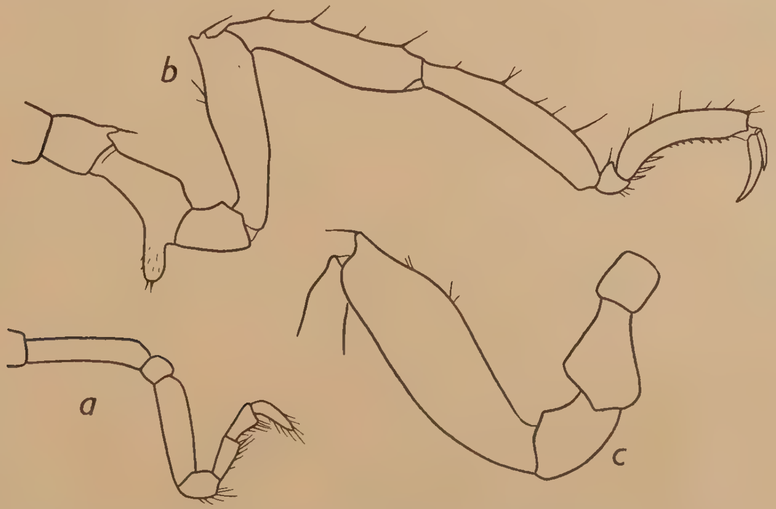

Fig. 62. *Achelia parvula*, Loman: *a*. Palp: × 60. *b*. Third leg of male: × 47. *c*. Proximal segments of third leg of female: × 47.

St. 53. 12. v. 26. Port Stanley, East Falkland Islands, hulk of "Great Britain", 0–2 m. Mussel rake: (1) numerous specimens[1], "sorted from washings from Hydroids and *Mytilus* clumps". (*b*) 2 specimens, "from washings from Kelp root".

St. 58. 19. v. 26. Port Stanley, East Falkland Islands, 1–2 m. Mussel rake: 4 specimens.

Remarks. These specimens agree well with Loman's description of *A. parvula*. As Loman's figures are rather poor the palp and third leg are represented again (Fig. 62).

Distribution. Previously recorded from Possession Bay, East Magellan Strait.

Genus **Austroraptus**, Hodgson

Hodgson, 1907, p. 54.
Calman, 1915, p. 62.

Each of the three known species of this genus is represented in the present collection. They may be distinguished from each other as follows:

I. Palp six-jointed in adult.
  A. Chela imperfect in adult; scape at least twice as long as wide, without dorsal tubercles; antero-lateral tubercles on cephalon obsolete .... *A. polaris*, Hodgson
  B. Chela perfect in adult; scape not more than half as long again as wide, with 1–2 dorsal tubercles; antero-lateral tubercles on cephalon present .... *A. praecox*, Calman
II. Palp eight-jointed [chela imperfect in adult] .... *A. juvenilis*, Calman

Austroraptus polaris, Hodgson.

Hodgson, 1907, p. 54, pl. viii, fig. 2.
Calman, 1915, p. 62, fig. 17 A–C.
Loman, 1923, p. 30.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ 00″ W, 342 m.; R. Large dredge: 1 ♂.

Distribution. This species has been recorded from the eastern and the western side of the Antarctic Zone.

Austroraptus praecox, Calman.

Calman, 1915, p. 65, fig. 19 A–E.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W, 155–178 m.; gn. M. S. Large otter trawl: 2 ♂♂.

Distribution. Cape Adare and South Georgia.

Austroraptus juvenilis, Calman.

Calman, 1915, p. 63, fig. 18 A–E.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m.; M. Large otter trawl: 1 ♀.

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[1] None of the males are carrying ova or larvae.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m.; gn. M. S. Large otter trawl: 2 ♂♂, with *A. praecox*.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ 00″ S, 58° 28′ 30″ W, 391 m.; M. St. Medium otter trawl: 1 ♀, 1 ♂, with *Nymphon charcoti*.

St. 363. 26. ii. 30. 2·5 miles S 80° E of SE point of Zavodovski Island, South Sandwich Islands, 329–278 m.; Sc. Large dredge: 1 ♂, bearing ? egg capsules or encysted Protozoa.

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. Large otter trawl: 1 ♂.

REMARKS. In the male from St. 363 large numbers of minute oval bodies are adhering to the appendages. These may be egg capsules or encysted Protozoa; they are found, in smaller numbers, attached to other Pycnogonida, e.g. *Tanystylum pfefferi* (Fig. 68 *b*).

DISTRIBUTION. Previously recorded from off Cape Adare.

Genus **Austrodecus**, Hodgson

Austrodecus glaciale, Hodgson (Figs. 63 and 64).

Hodgson, 1907, p. 53, pl. viii, fig. 1.
Bouvier, 1913, p. 147, figs. 96 and 97.
Calman, 1915, p. 66, fig. 20.
Loman, 1923, p. 31.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 3·3 miles S 44° E of Jason Light, 110 m.; M. R. Large dredge: 7 ♀♀, 15 ♂♂.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock, 179–235 m.; gy. M. Large otter trawl: 1 ♀.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light, 120–204 m.; M. Large otter trawl: 2 ♂♂, 1 ♀.

St. 53. 12. v. 26. Port Stanley, East Falkland Islands, hulk of 'Great Britain', 0–2 m. Mussel rake: 2 ♀♀, 1 ♂.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point to 1·2 miles S 62° W of Merton Rock, 230–250 m.; gy. M. Large otter trawl: 3 ♂♂, 8 adult and immature ♀♀.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W, 155–178 m.; gn. M. S. Large otter trawl: 1 ♂, 2 ♀♀ and 2 immature specimens.

St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, 130 m.; gy. M. St. 1 m. horizontal tow-net—net touched bottom: 3 immature specimens.

St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, 229–236 m.; Sh. c. w. S. Commercial otter trawl: 3 ♂♂, 3 ♀♀.

South Georgia:

St. MS 14. 17. ii. 25. From 1·5 miles SE × S to 1·5 miles S ½ W of Sappho Point, East Cumberland Bay, 190–110 m. Small dredge: 1 ♂.

St. MS 65. 28. ii. 26. East Cumberland Bay, 1·6 miles SE of Hobart Rock to 1 cable N of Dartmouth Point, 39 m. Small beam trawl: 1 immature specimen.

St. MS 66. 28. ii. 26. East Cumberland Bay, 2¼ miles SE of King Edward Point Light to 1½ cables W × N of Macmahon Rock, 18 m. Small beam trawl: 2 immature specimens.

St. MS 71. 9. iii. 26. East Cumberland Bay, 9¼ cables E × S to 1·2 miles E × S of Sappho Point, 110–60 m. Small beam trawl: 1 ♂, 6 ♀♀ and immature specimens.

St. MS 74. 17. iii. 26. East Cumberland Bay, 1 cable SE × E of Hope Point to 3·1 miles SW of Merton Rock, 22–40 m. Small beam trawl: 3 ♂♂, 1 ♀.

Remarks. Only one species of this very distinctive genus is known. The holotype of *A. glaciale*, a female from the Ross Sea area, has four bluntly conical tubercles on the mid-dorsal surface of the body and a pair of more acutely conical projections on the first coxa of each leg, the first excepted as the anterior one is absent.

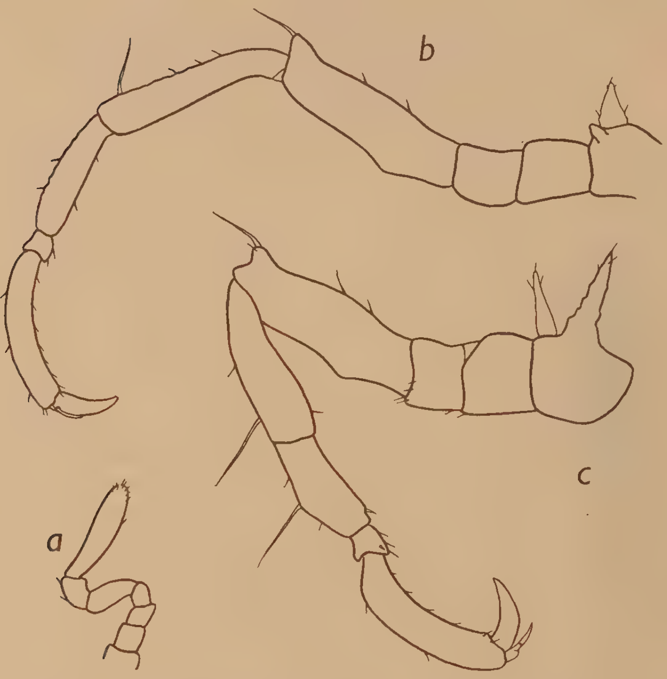

Fig. 63. *Austrodecus glaciale*, Hodgson. Male: *a*. Palp: ×100. *b*. Third leg—St. WS 228: ×60. *c*. Same—St. 53: ×100 (Group I).

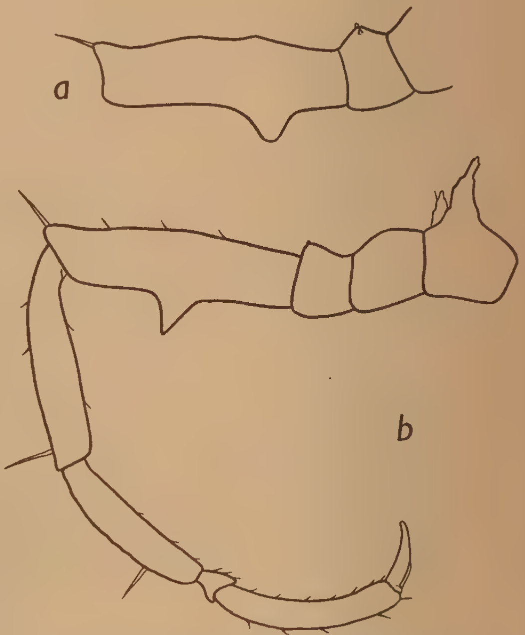

Fig. 64. *Austrodecus glaciale*, Hodgson. Male: *a*. Femur of third leg—Terra Nova collection (Group I). *b*. Third leg—St. 27 (Group II): ×60.

The numerous specimens in the Discovery collection fall into two groups. In the first group, which is represented by a relatively small proportion of individuals, there are either low conical, or high slender spinose projections on the mid-dorsal surface. Those specimens with high spinose projections have a similar arrangement of the coxal processes as in the holotype. Those specimens with lower, more robust, conical projections on the trunk have the coxal projections arranged as follows: a posterior one on the first coxa of each of the two anterior pairs of legs and an anterior one on the first coxa of each of the two posterior pairs of legs (in addition there is sometimes a very small posterior projection on the coxa of each third leg).

The second group, which includes the bulk of the material, is characterized by (1) the complete absence of any tubercles or processes on the dorsal surface of the trunk in adults and young, and (2) the presence of an anterior and a posterior conical projection on the first coxa of each walking leg. Also, in the males, the femoral cement-gland opens at the apex of a high, conical projection, whereas, in the first group, it is situated on a low blunt eminence.

The specimens in the Terra Nova collection (Calman, 1915, p. 66), also from the Ross Sea, agree very closely with the holotype; in the male the femoral tubercle is high, but more blunt and situated more proximally than is the acutely conical tubercle in the males of our second group (cf. Fig. 64 *a* and *b*).

It is doubtful if these forms all belong to one variable species; the walking legs show considerable differences (Figs. 63 and 64). The main differences described above may be represented briefly as follows:

Group I. Projections on mid-dorsal surface of trunk present; no anterior projection on first coxa of first leg.
- A. Projections on trunk low, rather robust, conical tubercles.
    1. Two projections on first coxa of legs 2–4; femoral gland in male opens at the apex of a high, wide, blunt cone (Fig. 64 *a*) Holotype and Terra Nova specimens
    2. One projection on first coxa of all the legs [a small posterior one may also be present on the third leg]; femoral gland in male opens at apex of a very low, blunt eminence (Fig. 63 *b*)............................Discovery, St. WS 228
- B. Projections on trunk high, slender, spinose; two high projections on first coxa of legs 2–4; femoral gland in male opens at apex of a low, blunt, rounded eminence (Fig. 64 *c*) ....Discovery, St. 53, St. WS 33

Group II. Projections on mid-dorsal surface of trunk absent; anterior and posterior projections on the first coxa of each leg; femoral gland in male opens at apex of a high, narrow cone (Fig. 64 *b*) ....Discovery—all the remaining stations

The material described by Bouvier (1913, p. 147), to judge from the arrangement of the coxal processes, is similar to that from WS 228. The low femoral tubercles in the male would be much more easily overlooked than the high conical ones, which are very striking even in immature specimens (see Calman, 1915, p. 67).

The males, in many cases, appear to be quite adult, although the genital openings have not been observed with certainty; in several instances there seemed to be a small opening on the second coxa of the last leg.

DISTRIBUTION. Probably circumpolar; recorded from the Ross Sea area, Graham Land region, South Georgia and the Magellan district.

Genus **Tanystylum**, Miers

A number of previous workers (e.g. Norman and Loman) regard the genus *Clotenia*, Dohrn, as a synonym of *Tanystylum*, Miers. Bouvier (1913, p. 45) retains *Clotenia*, at least provisionally, as distinct from *Tanystylum*, the former having only four, instead of six or seven segments in the palp. Bouvier, however, includes *T. hoekianum*, Schimk., in the genus *Clotenia*, although the palp is described and figured with six segments.

Bouvier lists seven[1] species of *Tanystylum*, and two[2] other species have since been described, namely *T. oedinotum*, Loman (1923, p. 29), and *T. ornatum*, Flynn (1928, p. 33). Several species are imperfectly known or known from a single specimen only (e.g. *T. hoekianum*, Schimk., *T. chierchiae*, Schimk., *T. calcirostre*, Schimk., and *T. oedinotum*, Loman). Therefore it has not been thought advisable to give a key to the determination of species not found in Antarctic and sub-Antarctic waters. The forms with a four-jointed palp are not represented in the Discovery collection, so that the question of the validity or non-validity of the genus *Clotenia*, Dohrn, cannot be discussed here.

Two Antarctic species, *T. styligerum*, Miers, and *T. pfefferi*, Bouvier, have recently been described elsewhere (Gordon, 1932 *a*, p. 87).

Key to the determination of the Antarctic and sub-Antarctic species:

Palp with seven segments:
  Long setose spines on walking legs; palpal segments 2 and 4 subequal, long; abdomen long, extending beyond the second coxa of the last leg................................*T. styligerum*, Miers
  No long setose spines on walking leg; palpal segment 2 longer than 4; abdomen extending to distal end of first coxa [a low, wide tubercle on dorsal surface of body, between ocular tubercle and abdomen] ....*T. oedinotum*, Loman

Palp with six segments, or with seventh segment more or less fused with sixth.
  Walking leg rather slender, second tibia nearly twice the sum of tarsus and propodus (1·75–1·9 : 1) ....*T. pfefferi* (typical form)
  Walking leg relatively shorter and more robust; second tibia only about 1·25 times the sum of tarsus and propodus ....*T. pfefferi* (Falkland I. var.)

Tanystylum styligerum, Miers (Fig. 65 *b*).

Nymphon styligerum, Miers, 1875, p. 76.
Tanystylum styligerum, Miers, 1879, p. 213, pl. xi, figs. 9–9 *d*.
Tanystylum kentrodes, Loman, 1923, p. 28, fig. E, 1–4.
Tanystylum longicaudatum, Hodgson, 1907 *a*, p. 13, figs. 4–6.
Tanystylum styligerum, Gordon, 1932 *a*, p. 88.

St. 53. 12. v. 26. Port Stanley, East Falkland Islands, hulk of 'Great Britain', 0–2 m. Mussel rake: 14 specimens, adults and young, "sorted from washings from Hydroids and *Mytilus* clumps" (with *Achelia parvula* and *Austrodecus glaciale*).

REMARKS. The specimens agree well with the co-types of *T. styligerum* (Gordon, 1932 *a*, p. 88). Several specimens resemble *T. kentrodes* (Loman, 1923, p. 28) in having a single long spine on the tubercle borne by each of the three anterior lateral processes. In other specimens there are 1–3 spines on each tubercle. The anterior border of the cephalon, measured to the outer rim of the sockets for the palps, is a little less (♂) or a little more (♀) than half the width across the second lateral processes.

The ocular tubercle is more slender and is set further forward than that represented

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[1] Excluding *T. hoekianum*, Schimk.; *T. longicaudatum*, Hodgson, however, appears to be a synonym of *T. styligerum*, Miers.

[2] *T. kentrodes* (Loman, 1923, p. 28) is also a synonym of *T. styligerum*.

in Loman's figure (1923, p. 28, fig. E, 1). The fourth palpal segment is not curved and is subequal to the second. The second may be a little shorter than the first tibia. The male oviger is represented in Fig. 65 *b*; the specimens are apparently not quite adult, as the genital pores are not yet present. The walking leg is considerably more slender than in the female.

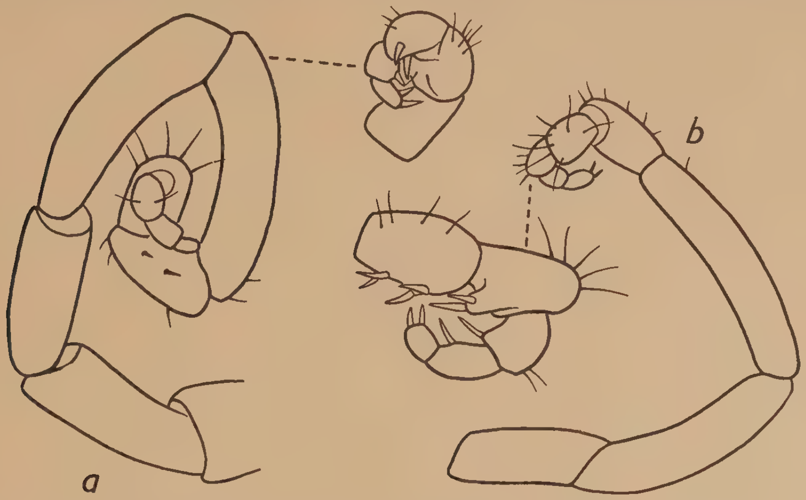

Fig. 65. *Tanystylum pfefferi*, Bouvier: *a*. Male oviger—specimen not quite adult: × 100. *T. styligerum*, Miers: *b*. Male oviger—St. 53: × 60 and 100.

Distribution. Kerguelen, the Falkland Islands and Beagle Channel near Tierra del Fuego.

Tanystylum pfefferi, Bouvier (Figs. 65 *a*, 66, 67 and 68).

Clotenia dohrnii, Pfeffer, 1889, p. 48.
Tanystylum pfefferi, Bouvier, 1913, pp. 5, 45 and 122.
Tanystylum pfefferi, Gordon, 1932, p. 90.

(*a*) Typical forms from:

St. WS 25. 17. xii. 26. Undine Harbour (North), South Georgia, 18–27 m.; M. S. Small beam trawl: 1 larvigerous ♂.

St. 456. 18. x. 30. 1 mile E of Bouvet Island, 40–45 m. Large dredge: 1 ♀, 1 larvigerous ♂, with *Nymphon australe*.

(*b*) Smaller forms from:

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Island, from 7 miles N 50° E to 7·6 miles N 63° E of Eddystone Rock, 105–115 m.; f. S. Large otter trawl: 1 ♂, 1 ♀.

St. 53. 12. v. 26. Port Stanley, East Falkland Island, hulk of 'Great Britain', 0–2 m. Mussel rake: many specimens, ♂♂, ♀♀ and young, "sorted from washings from Hydroids and *Mytilus* clumps"; one ♀ "from washings from Kelp root".

St. WS 124. 9. vi. 27. Gough Island, Penguin Island anchorage, 40° 16′ S, 9° 58′ W, 40–60 m. Large dredge: 1 ♀, 1 ovigerous ♂.

St. 4. 30. i. 25. Tristan da Cunha, 36° 55′ S, 12° 12′ W, 40–46 m.; St. Large dredge: 1 specimen from debris of stones with encrustations.

Remarks. The specimens from WS 25 and St. 456 agree very closely with the female specimen from the Hamburg Museum collection described elsewhere (Gordon, 1932 *a*, p. 90). The almost vertical abdomen, the very short chelophores, the low, wide ocular tubercle and the relative proportions of the palpal segments are characteristic of the species.

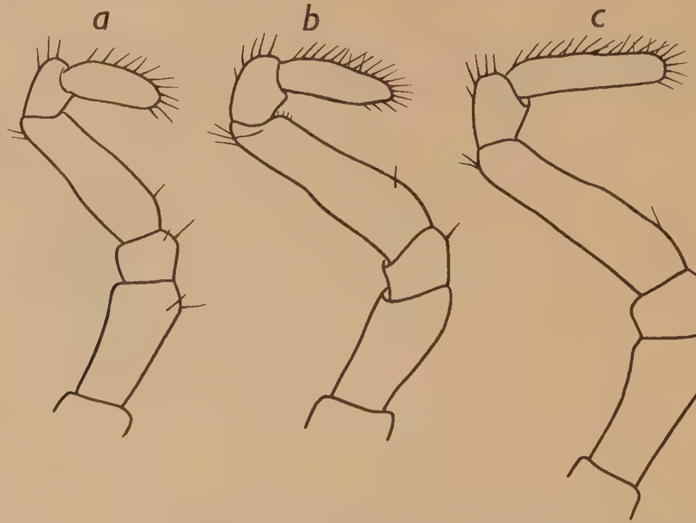

Fig. 66. *Tanystylum pfefferi*, Bouvier. Palp: *a*. St. 53, Falkland Islands: × 100. *b*. St. WS 124, Gough Island: × 80. *c*. St. 456, Bouvet Island: × 60.

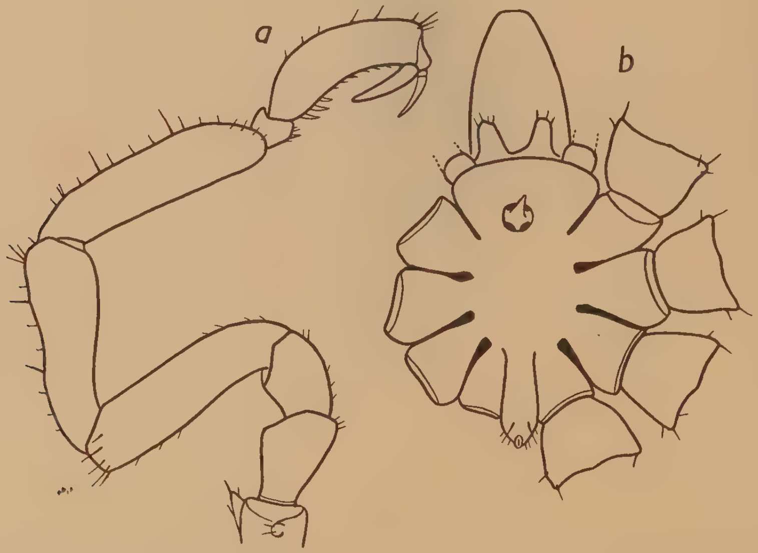

Fig. 67. *Tanystylum pfefferi*, Bouvier. Male—St. 53: *a*. Third leg. *b*. Dorsal view of body with chelophores and first coxae: × 47.

There is a distinct tendency for papal segments 6 and 7 to unite; sometimes a suture appears to be present, but when the palp is cleared and mounted on a slide, no actual suture can be detected. Sometimes there is a distinct median emargination on one side separating the setae into two groups (Gordon, 1932 *a*, p. 92, fig. 4*c*). Occasionally no emargination occurs and the lateral setae are uniformly arranged, so that all trace of fusion is obliterated and the palp has the appearance of a normal six-jointed appendage (Fig. 66 *c*).

The egg masses are irregularly-shaped rings strung on each oviger like beads on a thread; they number 1–4 on each oviger (the male oviger is represented in Fig. 65 *a*). There are three pairs of male genital openings.

The specimens from the Falkland Islands differ considerably from typical *T. pfefferi*. (1) The palp is six-jointed (without any trace of a seventh segment) and the terminal segment is shorter, not equal to or longer, than the second segment (Fig. 66 *a*). (2) The walking leg is more robust and the propodus and tarsus are considerably longer relative to the second tibia $\left(\frac{\text{length of second tibia}}{\text{length of tarsus + propodus}} = \frac{1\cdot25}{1} \text{ instead of } \frac{1\cdot75\text{–}1\cdot9}{1}\right)$. The other differences are very slight. (3) The specimens are of much smaller size, yet many females and at least one male have genital apertures (see measurements). (4) There is usually a narrow conical process on the ocular tubercle above the level of the eyes. (5) There are as a rule no setae or tubercles on the lateral processes. (6) The abdomen is more oblique. (7) The chelophores are rather longer (Fig. 67 *a* and *b*).

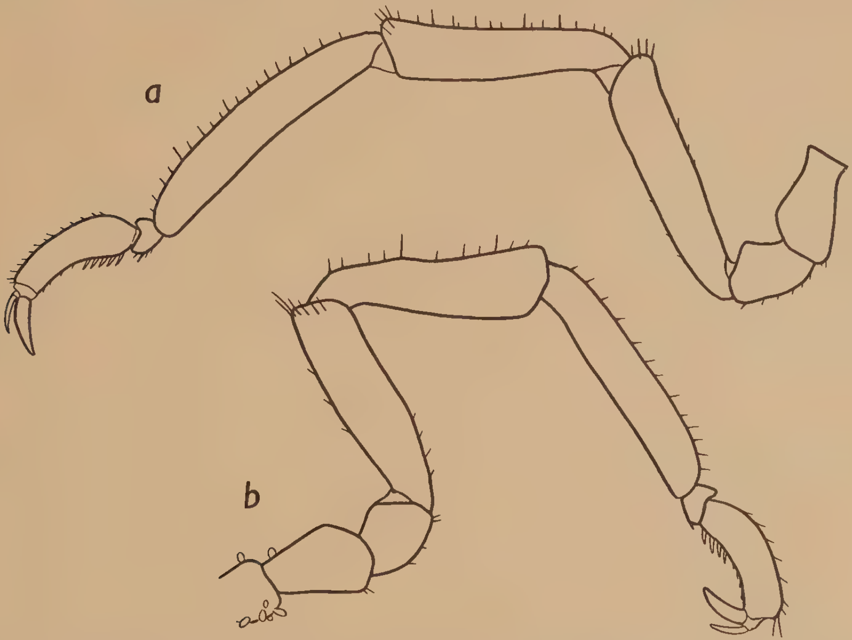

Fig. 68. *Tanystylum pfefferi*, Bouvier. Third leg of male: *a*. Typical—St. WS 25. *b*. St. WS 124; a number of small capsules (? encysted Protozoa) attached to first coxa.

The specimens from Gough Island (WS 124) are much more like the typical form. The abdomen is nearly vertical, the ocular tubercle and the chelophore are quite typical, and the walking leg, though somewhat more robust, has a long second tibia (Fig. 68 *b*: cf. Figs. 68 *a* and 67 *a*). There are one or even two small rounded tubercles on each lateral process. The palp is again six-jointed, the terminal segment being equal to the second (Fig. 66 *b*). It is perhaps of interest to note that the egg mass in this instance is single and carried on both ovigers.

For the present it is advisable to refer all these forms to a single species because of the variation that occurs typically in the terminal segment (or segments) of the palp in *T. pfefferi*. The specimens from Gough Island and that from Tristan da Cunha, although found beyond the northernmost limits of the sub-Antarctic Zone, can hardly be distinguished from the South Georgian specimens—except as regards the egg mass and the palp. The specimens from the Magellan district include no ovigerous males, but the walking legs of some of the females contain developing ova, so that it is highly probable that adults do not exceed 1 mm. in trunk length. The smaller ratio between the lengths of the second tibia and tarsus plus propodus can hardly be regarded as of specific importance. Calman (1915, p. 59, figs. 13 and 14) found a similar type of variation in *Achelia spicata*, although in that case the specimens were (with two exceptions) from one locality. The numerous specimens from the hulk of the 'Great Britain' are a pure culture. In such a limited area close inbreeding doubtless occurs.

The breeding season appears to vary somewhat, males from the first two stations were carrying larvae in October and December; the single male from Gough Island was carrying eggs as early as July.

Measurements (*mm.*)

	♂ (St. WS 25)	♂ (St. 53)	♂ (St. 124)
Length of proboscis	1·2	0·55	0·82
Greatest width of proboscis ...	0·55	0·3	0·4
Length of trunk	1·65	0·8	1·1
Width across second lateral processes	1·75	0·9	1·1
Length of abdomen	0·7	0·33	0·4
Length of chelophore	0·2	0·13	0·13
Third leg:			
Coxae	1·6	0·7	0·95
Femur	1·8	0·73	1·0
First tibia	2·05	0·79	1·2
Second tibia	2·4	0·8	1·3
Tarsus and propodus	1·2	0·6	0·75
Claw	0·5	0·3	0·25
Auxiliaries	0·35	0·15	0·2

Distribution. South Georgia, the Falkland Islands, Gough Island and Tristan da Cunha.

Genus **Rhynchothorax**, Costa

Rhynchothorax australis, Hodgson.

Hodgson, 1907, p. 57, pl. viii, fig. 3; 1915, p. 148.
Calman, 1915, p. 67, fig. 21.
Loman, 1923 *a*, p. 12.

St. WS 84. 24. iii. 27. 7½ miles S 9° W of Sea Lion Island, East Falkland Islands, from 52° 33′ S, 59° 08′ W to 52° 34′ 30″ S, 59° 11′ 00″ W, 75–74 m.; c. S. Sh. St. Commercial otter trawl: 1 immature specimen.

Distribution. Ross Sea area and the Magellan district.

Genus **Nymphopsis**, Haswell

Nymphopsis denticulata, n.sp. (Figs. 69 and 70).

St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Islands, from 52° 09′ S, 58° 14′ W to 52° 08′ S, 58° 09′ W, 79 m.; S. Sh. Commercial otter trawl: 1 ♀.

DESCRIPTION. *Trunk* compact; lateral processes in contact, 1–3 each with an anterior and a posterior spinose process, 4 with an anterior one only (Fig. 69). Cephalic segment distinctly separated off by a suture from the succeeding segments, which are all completely fused. Two acute antero-lateral spinose processes on cephalon; ocular tubercle high, tubular, situated mid-way between these on the anterior border of cephalon. Eyes large, sub-terminal. Two high, slender, spinose projections on mid-dorsal surface, between cephalic suture and abdomen (Fig. 69).

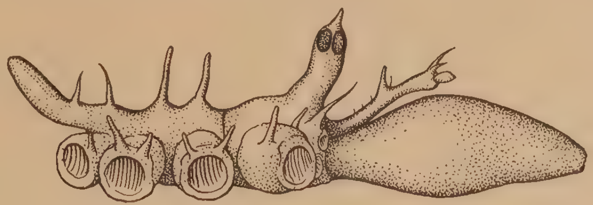

Fig. 69. *Nymphopsis denticulata*, n.sp. Holotype. Lateral view of body with chelophore: × 30.

Proboscis slightly longer than trunk, ovate, tapering anteriorly to a blunt point (Fig. 69).

Abdomen, long, slender, sub-cylindrical, elevated in distal half and reaching a little beyond the distal end of the second coxa; two small spinose projections on proximal half (Fig. 69).

Chelophore approximately half as long as proboscis. Scape of almost uniform diameter throughout and consisting of a single segment; a short, stout, spinose process on the mid-dorsal surface, a bifurcated process at the inner, and two smaller spines at the outer distal angle (Fig. 70 *a*, lateral aspect). Chela small and imperfect.

Palp as represented in Fig. 70 *b*, nine-jointed and longer than proboscis.

Oviger ten-jointed, with one or two denticulate spines on the four terminal segments as in some species of *Achelia* (Fig. 70 *c*: cf. Fig. 59 *a*, *c*); terminal claw absent.

Walking leg. The second walking leg, which was already detached from the specimen, is represented in Fig. 70 *d* and *e*; the spinose setae are simple, not compound and the auxiliary claws are at least two-thirds as long as the main claw. Ova are present in the two distal coxae and in the femur.

Measurements (*mm.*)

Length of proboscis	1·35	Second leg:	
Greatest width of proboscis	0·6	Coxae	1·2
Length of trunk	1·13	Femur	1·4
Length of cephalic segment	0·6	First tibia	1·4
Width of anterior border of cephalon	0·67	Second tibia	1·47
Width across first lateral processes	1·2	Tarsus and propodus	0·87
Length of abdomen	0·6	Claw	0·35
Length of chelophore	0·68	Auxiliaries	0·25

Remarks. This specimen differs from the four known species of the genus in having (1) the cephalic segment separated off from the remaining trunk segments, (2) simple instead of compound spines on the legs, (3) the scape of approximately uniform diameter throughout, and not hollowed out to form a cup or collar[1] around the proximal part of the chela, and (4) denticulate spines on the terminal segments of the oviger. These differences are not of generic importance.

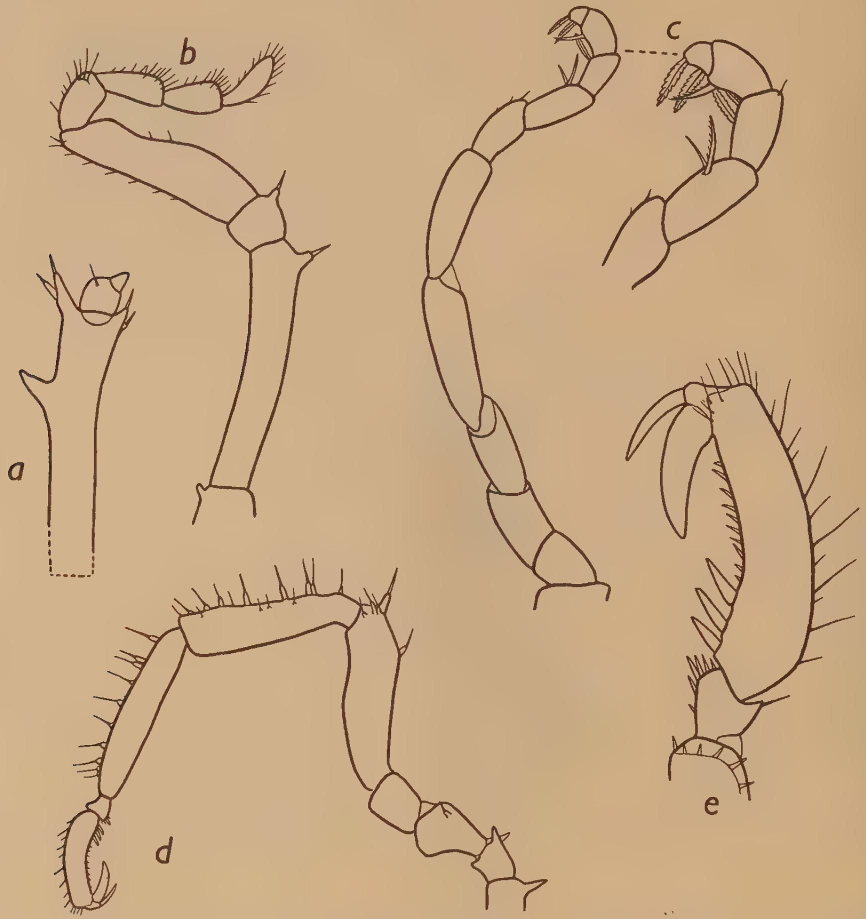

Fig. 70. *Nymphopsis denticulata*, n.sp. Holotype: *a*. Chelophore, lateral view. *b*. Palp. *c*. Oviger and terminal segments, further enlarged. *d*. Second left leg. *e*. Terminal segments of same, further enlarged. (*a*, *b*, *c* and *e*: × 60.)

In three species—*N. armatus*, Haswell (Flynn, 1919, p. 84, pl. xxi, fig. 18), *N. korotnewi*, Schimkewitsch, and *N. muscosus*, Loman (1908, pp. 50–53, pl. xiii, figs. 175–188)—the chelophore exceeds the proboscis in length. In the remaining two species—*N. abstrusus*, Loman, and *N. denticulata*—the chelophore is shorter than the proboscis. The former differs from the latter species, however, in having a two-jointed scape and three, instead of two, spinose projections on the dorsal surface of the trunk.

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[1] *N. abstrusus*, Loman, also seems to have no projecting collar round the chela, but the figures given are very small (Loman, 1923 *a*, p. 8, fig. D 1 and 2).

Distribution. This is the first record of the genus from the western side of the sub-Antarctic Zone.

Family PYCNOGONIDAE

Genus Pycnogonum, Brünnich

Pycnogonum rhinoceros, Loman (Fig. 71 *c*).

Loman, 1923, p. 7, fig. A, 1–5.

St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 238–270 m.; gy. M. Large otter trawl: 1 ♂.

Remarks. A single, large male undoubtedly belongs to this species. The type specimens were not quite adult and the oviger (Loman, 1923, fig. A, 3, p. 8) possessed only seven segments. In the Discovery specimen the oviger is nine-jointed, with a short terminal claw (Fig. 71 *c*). Loman states that there is "no trace of eyes"; in the Discovery specimen, however, eyes are present and the anterior is larger than the posterior pair.

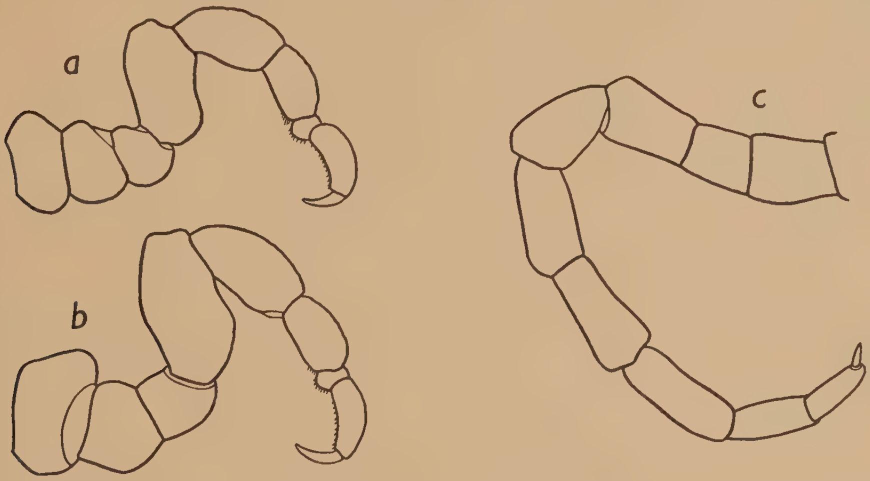

Fig. 71. *Pycnogonum platylophum*, Loman: *a*. Third leg of male. *b*. Same of female. (Both: × 20.)
P. rhinoceros, Loman: *c*. Oviger of male.

Measurements (mm.)

Length of proboscis	7·0
Greatest width of proboscis	3·7
Length of trunk	9·6
Length of cephalic segment	2·6
Width of cephalon	3·5
Width across second lateral processes	7·3
Length of abdomen	2·4

Third leg:	
First coxa	1·6
Second coxa	2·0
Third coxa	0·9
Femur	4·4
First tibia	4·8
Second tibia	4·0
Tarsus and propodus	2·8
Claw	1·0

Distribution. South Georgia.

Pycnogonum platylophum, Loman (Fig. 71 *a*, *b*).

Loman, 1923 *a*, p. 10, fig. E, 1–5.

St. WS 88. 6. iv. 27. 54° 00′ S, 64° 57′ 30″ W, 118 m.; S. Sh. St. Commercial otter trawl: 1 ♂.

St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, West Falkland Islands, from 51° 51′ S, 61° 30′ W to 51° 54′ S, 61° 30′ W, 133–130 m.; gy. S. Commercial otter trawl: 1 ♀.

Measurements (*mm.*)

	♂	♀
Length of proboscis	2·0	3·0
Basal width of proboscis	1·17	1·6
Length of trunk	3·65	5·0
Length of cephalic segment	1·4	2·07
Width of cephalon (anterior border)	1·4	1·8
Width across second lateral processes	2·45	3·4
Length of abdomen	1·2	1·3

REMARKS. These specimens differ from the holotype described by Loman (1923 *a*, p. 10, fig. E) in one minor point—namely, in having the lateral processes in contact instead of separated by narrow intervals. Fig. 71 *a* and *b* represents the third right leg of the male and of the female respectively. The female is rather soft and of a light brownish-yellow colour; the male is much darker brown in colour, with more slender walking legs. The genital pores are present in each specimen.

DISTRIBUTION. Sub-Antarctic, from the Magellan district.

Pycnogonum magellanicum, ? Hoek (Fig. 72).

P. magellanicum, Hoek, 1898, p. 296, pl. iii, figs. 20 and 21.
? *P. magnirostre*, Möbius, 1902, p. 194, pl. xxx [vii], figs. 12–14.

St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, 229–236 m. Commercial otter trawl: 1 ♂, 1 ♀.

St. 399. 18. v. 30. 1 mile SE of SW point of Gough Island, 141–102 m. Large dredge: 1 ♀, 1 ovigerous ♂.

DESCRIPTION OF MALE (WS 228). *Trunk* compact, three distinct transverse body ridges present, each with a median, round, blunt tubercle; a similar tubercle on each lateral process. Lateral processes 2–4 each in contact with the preceding body ridge. Cephalic segment equal to the sum of the two succeeding segments; ocular tubercle situated on a broad slightly raised ring near the anterior border of cephalon and not quite as high as wide; eyes large. Width across first a little greater than that across second lateral processes.

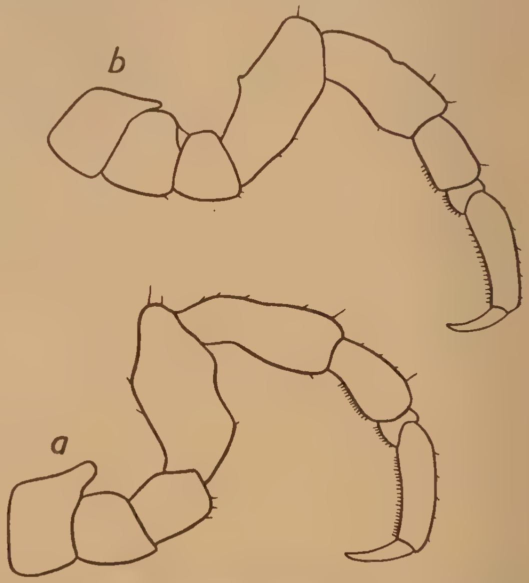

Fig. 72. *Pycnogonum magellanicum*?, Hoek: *a*. Third leg of male. *b*. Same of female—St. WS 228. (Both: × 20.)

Proboscis a little shorter than cephalic segment, bluntly conical.

Abdomen somewhat clavate, reaching to distal end of second coxa of fourth leg.

Oviger short, with nine small segments and a terminal claw. The left oviger has been entirely suppressed and there is no trace of the small process to which it ought to be attached.

First coxae at least twice as wide as long, the anterior distal angle of each is drawn out into a triangular lobe.

Third leg as represented in Fig. 72 *a* and at least half as long again as the trunk.

Female. The transverse body ridges and the anterior rim of the cephalon are more pronounced than in the male. There are two small pointed tubercles a short distance behind the ocular tubercle—these are much smaller in the male. The ovigers are, of course, wanting, and there is a low, round tubercle dorsally on the second coxa of the last leg.

The genital openings are apparently not yet present in the female, but they are quite distinct in the male.

Measurements (mm.)

	Holotype	St. WS 228		St. 399	
	♀	♂	♀	♂ (ovig.)	♀
Length of proboscis	3·2	1·2	1·2	0·93	1·1
Basal width of proboscis	1·8	0·9	0·9	0·67	0·9
Length of trunk	5·73	3·7	3·8	2·5	3·5
Length of cephalic segment	2·2	1·6	1·4	1·0	1·3
Width of anterior border of cephalon	2·0	1·3	1·35	0·87	1·2
Width across second lateral processes	4·0	2·45	2·6	1·45	2·0
Length of abdomen	1·4	1·2	0·95	0·53	0·6
Third leg:					
Coxae	1·8	1·0	1·1	0·6	0·73
Femur	1·7	1·3	1·1	0·5	0·63
First tibia	1·6	1·3	1·1	0·5	0·6
Second tibia	1·0	0·7	0·55	0·35	0·4
Tarsus and propodus	—	1·07	1·05	0·5	0·55
Claw	—	0·5	0·5	0·25	0·24
L. of trunk ÷ w. across 2nd lateral processes	1·43	1·51	1·46	1·72	1·75
L. of abdomen ÷ l. of trunk	0·24	0·32	0·25	0·21	0·17
L. of third leg ÷ l. of trunk	—	1·59	1·42	1·04	0·9

REMARKS. The specimens from St. 399 differ from those just described in the following respects. (1) The trunk is narrower, with lower transverse body ridges and lower median tubercles. (2) The third leg is subequal to, instead of approximately half as long again as the trunk length. (3) The abdomen also is shorter, although it again reaches to the distal end of the second coxa (see ratios above). (4) The lateral processes are separated by narrow intervals. The genital openings are quite distinct in each specimen.

The Discovery specimens are referred provisionally to *P. magellanicum*, although they do not agree with each other or with the holotype. Hoek's figure (1898, pl. iii, fig. 20) does not show the transverse body ridges nor the low median tubercles of the holotype, which in this respect agrees with the specimens from St. 399. In other respects the holotype agrees more closely with the specimens from WS 228, e.g., as regards width of trunk and length of abdomen (see ratios above). The third leg is incomplete; but the sum of the segments measured exceeds the trunk length, so that the complete leg would probably be about half as long again as the trunk.

The holotype has a much longer proboscis than any of the Discovery specimens, being almost as long as the sum of the first two segments. *P. magnirostre*, Möbius (1902, p. 194, pl. xxx, figs. 12–14), from Kerguelen also has a very long proboscis and may prove to be identical with *P. magellanicum*. It is possible that more than one species of *Pycnogonum* is represented, but the five specimens measured above are not sufficient to enable one to settle this point satisfactorily.

Distribution. Off the Falkland Islands and Gough Island.

THE CENTRAL NERVOUS SYSTEM IN DECOLOPODA

The nervous system is very similar to that described for *Colossendeis* by Hoek (1881, pp. 108–119, pl. xvii, fig. 2 and pl. xviii, fig. 4). The long circum-oesophageal commissures, considerably foreshortened in Fig. 73 A, enclose the oesophagus and a pair of somewhat triangular muscles that work the proboscis.

The usual main nerves arise from the supra-oesophageal ganglia, namely: *a*, a median azygous proboscidial nerve; *b*, a pair of optic nerves each dividing into three branches to innervate the anterior eye, the "sense organ"[1] and the posterior eye respectively (see Fig. 73 C), and *c*, a pair of nerves to the chelophores. A pair of fine nerves, *d*, probably correspond to those designated by Wirén (1918, pp. 73 and 79, figs. 10, 14 and 15) as nerves No. 3 in *Nymphon grossipes-mixtum*[2]. But, instead of pursuing a course parallel to the azygous proboscidial nerve, as in *Nymphon*, they pass obliquely outward and forward towards the base of the chelophores, innervating the muscles that work these appendages. Near to these latter nerves, a pair of thin strands arise (*e*) and run directly forwards to break up into a meshwork innervating the skin along the anterior border of the cephalon. In *D. antarctica* this pair of nerves is well seen (Fig. 73 B, *e*), but in the dissections of *D. australis* they were, as a rule, removed with the skin. *D. antarctica* differs from *D. australis* in two respects: (1) the optic nerve is much stouter, with shorter thicker branches; (2) nerve *d* arises from the optic nerve. In the specimen from which Fig. 73 B was obtained, nerve *d* arose from the base of the median branch of the optic nerve on the left side, as represented in the diagram, whereas on the right side it arose from the main stalk of the optic nerve just below the forking.

From the first thoracic ganglionic mass three pairs of nerves arise (Fig. 73 A, 1, 2, 3) innervating the proboscis, palps and ovigers respectively. In *D. antarctica* from St. 42 the proboscidial nerves arise each from the circum-oesophageal commissure a short distance from the thoracic ganglionic mass; in the male from St. 149 the nerve on the left arises similarly from the commissure, while that on the right arises from the ganglionic mass (as in *D. australis*, Fig. 73 A).

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[1] Probably a vestigial eye (see Loman, 1924, p. 318).

[2] Only present in *Nymphon* (Wirén, 1918, pp. 73 and 77).

Wirén (1918, p. 80, fig. 16) illustrates a nerve, designated as No. 5, arising from near

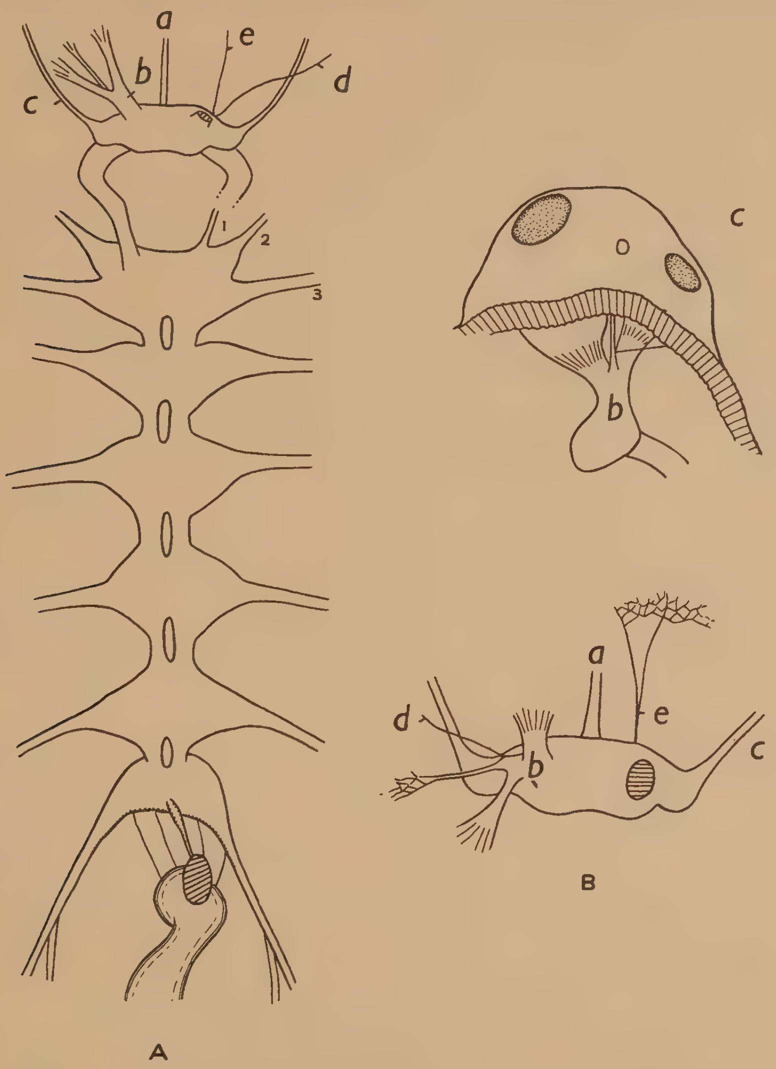

Fig. 73. *Decolopoda australis*, Eights: A. Central nervous system: × 13. *Decolopoda antarctica*, Bouvier. B. Supra-oesophageal ganglia and their associated nerves (diagram). C. Optic nerve and its branches below the ocular tubercle: ×13.

a. Median azygous proboscidial nerve. *b*. Optic nerve. *c*. Nerve to chelophore. *d*. Nerve to muscle working chelophore. *e*. Superficial nerve to anterior border of cephalon. 1, 2 and 3. Nerves to proboscis, palp and oviger respectively.

the base of the circum-oesophageal commissure in *Colossendeis*; this nerve (1918, pp. 73–4) passes right forward to the base of the proboscis, near to the point of insertion of the palp, to innervate muscles. In *D. antarctica* I have been unable to discover this nerve, neither was it observed in the specimen of *D. australis* from St. 149 represented in Fig. 73 A; but a very slender nerve strand was present in one of the specimens from St. 154.

As anticipated, the ventral nerve chain in *Decolopoda* possesses six, instead of the usual five, ganglionic masses. The lateral nerves to palp, ovigers and each leg soon bifurcate.

ABNORMALITIES

Abnormalities occur very infrequently in Pycnogonida; at any rate, in the large Discovery collection the following few examples are all that were noted,[1] apart from the occasional loss and subsequent regeneration of a walking leg.

1. *Palp*. The tip of the palp is sometimes slightly abnormal, e.g. (i), the right palp of *Colossendeis tortipalpis*, n.sp., represented in Fig. 2*e*; (ii), the left palp of *Ammothea*, sp.? described on p. 108 and (iii), the right palp of the holotype of *Ammothea calmani*, n.sp. (Fig. 74 *a*), where segments 7 and 8 appear to be fused. In the last example the notch *x* (Fig. 74 *a*) may represent the beginning of bifurcation or of segmentation.

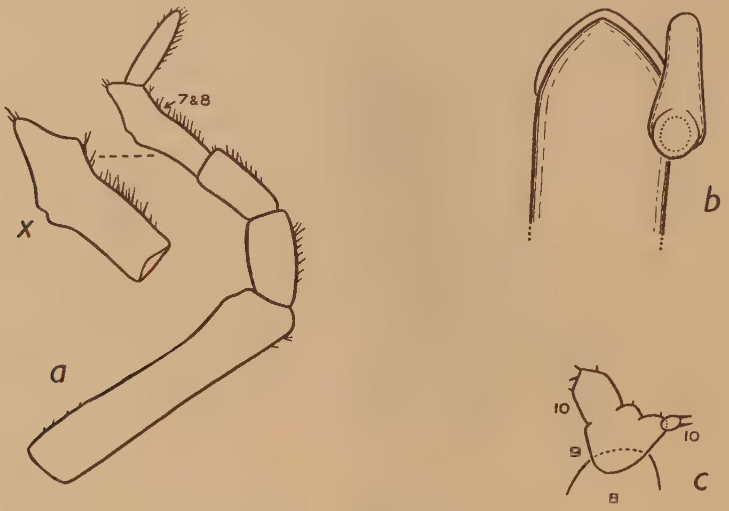

Fig. 74. *a*. *Ammothea calmani*, n.sp. Holotype. Segments 4–9 of right palp—segments 7 and 8 are apparently fused: ×15 and 20.

b. *Decolopoda antarctica*, Bouvier. Proximal portion of abdomen, showing additional small clavate process on right side: ×20.

c. ?*Pallenopsis* sp. St. 256. Terminal segments of oviger showing distinct bifurcation: ×100.

The most extreme case of abnormality is the tripartite palp of *Nymphon proceroides*, Bouvier (Fig. 75). Here *a* is probably the original left palp, bearing the two extra palps on the outer distal angle of the second segment. The long axes of palps *a*, *b* and *c* lie in one plane; *b* is a mirror image of *a* and *c* of *b*, according to the two rules enunciated by Bateson (1894, p. 479).

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[1] Two of the abnormalities figured (Figs. 74 *a*, 75) occurred in specimens from other collections.

These variations are sporadic and may be the result of some slight injury; in one species, however, slight palpal abnormalities occur so frequently as to be characteristic of the species. In *Decolopoda antarctica*, Bouvier (fig. 1, *a–e*), the number of palpal segments varies from 8 to 10 (Table I). Until a large number of specimens are available for study it is impossible to say whether eight or nine is the normal number of segments. Three of the seven specimens examined have both palps eight-jointed as in Fig. 1 *a*; one specimen has both palps nine-jointed. The numbers of palpal segments in each of the seven specimens may be represented as follows: 8, 8; 8, 8; 8, 8; 9, 9; 8, 9; 8 + (fig. 1 *d*), 8; 8 + (fig. 1 *c*), 9 + (fig. 1 *e*). The vestigial ninth or tenth segment (Figs. 1 *d* and 1 *e*) may resemble a minute claw. Calman (1920, p. 244) puts forward the view that "the assumption of a claw-like form by the terminal segment may, perhaps, be regarded as a case of homœosis" since all appendages posterior to the palp may end in claws. Occasionally the terminal segment is somewhat abnormal, as in Fig. 1 *b*, suggesting regeneration of the apex after mutilation. Judging from the abundance of encrusting organisms found on *Decolopoda antarctica*, it must be a very sluggish species (see p. 132), and thus it may be unusually liable to have the palp nibbled by an Isopod or some such animal.

2. *Oviger*. In one instance—*Pallenopsis* sp.?, St. 256—the tip of the oviger has bifurcated (Fig. 74 *c*); in fact segment 9 has almost the appearance of trifurcating.

Quite a different type of abnormality occurred in a male of *Pycnogonum magellanicum*? (WS 228), where the left oviger was entirely suppressed, that on the right side being present.

3. *Ocular tubercle*. A specimen of *Austrodecus glaciale*, Hodgson, had had the greater part of the ocular tubercle removed as the result of some accident. The wound had healed over without any apparent attempt at regeneration. The long ocular tubercle is so conspicuous a feature of this species that the low blunt stump attracted attention at once. Perhaps, had the animal undergone another moult, the deficiency might have been made good. But there is no experimental evidence on this point.

4. *Abdomen*. It is interesting to find, in a species showing frequent variation in the distal segmentation of the palp, the following peculiarity. In the specimen of *Decolopoda antarctica* from St. 164 there is, to the right of the abdomen, a short, ? movable, clavate process projecting from the posterior end of the trunk (Fig. 74 *b*). A small circular area at the posterior end is thin and membranous, but it is rather difficult to decide whether it is perforate. Unfortunately the process was detached from the specimen after the camera lucida drawing had been made; only a very small indication of the point of attachment can now be observed. This process may be interpreted as an abortive second abdomen.

5. *Auxiliary claw*. The third right leg of *Pentanymphon antarcticum*?, Hodgson, from St. 170, has two auxiliary claws on the anterior side, and only one, as is usual, on the posterior side of the main claw. There is no reversal of symmetry here and no

indication of a median reversed claw between these two auxiliaries. The outer, or dorsal, is probably the original auxiliary, since it is on a level with and subequal to the auxiliary on the posterior side. The inner, additional auxiliary is very small.

6. The female of *Nymphon tenuipes*, Bouvier (p. 38), is interesting in that the two anterior pairs of walking legs are shorter and much more slender than the two posterior pairs and do not contain developing ova. It is possible that all four anterior legs were lost and subsequently regenerated, although the loss of so many legs at one and the same time would be a rare occurrence. It is just possible, of course, that the original specimen was cut in two halves and that the whole anterior portion of the body was regenerated. This is highly improbable, however, for Loeb (1895, p. 251), experimenting with *Phoxichilidium maxillara*, found that "Bei den aboralen Hälften konnte ich dagegen nur eine Anschwellung am vorderen Ende wahrnehmen". The trunk, chelophores, palps and ovigers are all apparently quite normal and show the normal relative proportions; if the whole anterior half of the body had been regenerated it would very likely have been small in proportion to the posterior half. Another possible explanation may be advanced tentatively, namely, that in this species the female has normally only two pairs of genital openings as in the male; but until more females are available the specimen may be regarded as somewhat abnormal.

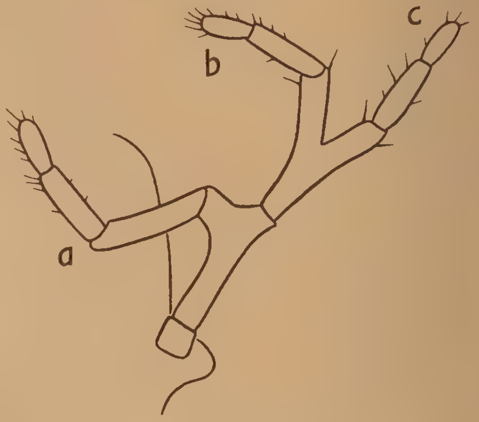

Fig. 75. *Nymphon proceroides*, Bouvier. Co-type. Ventral view of left palp.

ENCRUSTING ORGANISMS

Encrusting organisms are found on Pycnogonida with far greater frequency than on Crustacea, for example. These are chiefly encrusting Polyzoa, adherent Foraminifera and Hydroids; but, in addition, an occasional Brachiopod, Sponge, Tunicate, Serpulid and Cirripede (*Scalpellum*) may be attached. Occasionally, also, one or two Isopods may be found clinging to a Pycnogonid.

From the abundance of encrusting Polyzoa found on *Decolopoda antarctica*, compared to those on *D. australis*, it is evident that the former must be a more sluggish species than the latter (see list below). Polyzoa are also found growing on five species of *Ammothea*—e.g. the specimen of *A. striata* from St. 167 has very large patches of *Alcyonidium* entirely covering a number of the long segments of the legs. Perhaps these species are also rather sluggish, but the numbers of individual specimens are too small to enable one to be at all dogmatic on this point. With the exception of *Colossendeis glacialis*, the remaining species on the list are each represented by a large number of specimens; one would therefore expect to find a certain number of Polyzoa on at least some of the specimens in each case.

The Polyzoa and Tunicata listed below have been determined by Dr Anna B. Hastings of the British Museum (Natural History).

POLYZOA

Schizoporella hyalina var. *discreta* (Busk)	on	*Decolopoda antarctica*	St. 140
Crisia sp. *Membranipora galeata*, Busk **Schizoporella hyalina* (Linn.) var.? *Osthimosia* sp.	on	*Decolopoda antarctica*	St. 123
Figularia sp. *Schizoporella hyalina* (Linn.) var. ?	on	*Decolopoda antarctica*	St. 39
Figularia sp. *Schizoporella hyalina* (Linn.) var. ?	on	*Decolopoda antarctica*	St. 149
Schizoporella hyalina var. *discreta* (Busk)	on	*Decolopoda antarctica*	St. 164
Schizoporella hyalina var. *discreta* (Busk)	on	*Decolopoda australis*	St. 154
Schizoporella hyalina (Linn.) var. ?	on	*Colossendeis glacialis*	Sts. 155 and 148
Schizoporella hyalina var. *discreta* (Busk)	on	*Colossendeis glacialis*	St. 149
Osthimosia sp. *Membranipora galeata*, Busk *Alcyonidium* sp. *Barentsia discreta* (Busk)	on	*Nymphon charcoti*	St. 39
Membranipora galeata, Busk *Schizoporella hyalina* (Linn.) var. ?	on	*Nymphon charcoti*	St. MS 68
Schizoporella hyalina (Linn.) var. ?	on	*Nymphon charcoti*	St. 195
Cellaria sp. *Schizoporella hyalina* (Linn.) var. ? *Osthimosia* sp.	on	*Nymphon australe*	St. 45
Osthimosia sp.	on	*Nymphon australe*	St. 182
Supercytis sp. *Schizoporella hyalina* (Linn.) var. ?	on	*Nymphon australe*	St. 42
Osthimosia sp.	on	*Pallenopsis patagonicum*	St. 84
Schizoporella hyalina (Linn.) var.	on	*Pallenopsis patagonicum*	St. 167
Tubulipora sp. *Amastigia nuda*, Busk	on	*Pallenopsis patagonicum*	St. WS 84
Crisia sp. *Schizoporella hyalina* (Linn.) var.	on	*Ammothea gigantea*, n.sp.	St. 371
Schizoporella hyalina var. *discreta* (Busk)	on	*Ammothea carolinensis*	Cumberland Bay
Schizoporella hyalina (Linn.) var. ?	on	*Ammothea minor*	Sappho Point and St. 371
Schizoporella hyalina var.	on	*Ammothea minor*	St. 190
Schizoporella hyalina var. *Alcyonidium* sp. *Osthimosia* sp.	on	*Ammothea striata*	St. 167
Schizoporella hyalina var.	on	Holotype of *Ammothea stylirostris*, n.sp.	St. 39

TUNICATA

The Tunicates on *Nymphon charcoti*, St. MS 68, *N. hiemale*, St. 39, and *Ammothea gigantea*, St. 371 all belong to the family Polycitoridae (Distomidae).

* *Schizoporella hyalina* var.? is very near the typical British form. By *Schizoporella hyalina* var. (unqueried) I have indicated a distinct variety for which, at present, I have not found a name. [A. B. H.]

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REPORT ON PENGUIN EMBRYOS COLLECTED DURING THE DISCOVERY INVESTIGATIONS

By

C. W. PARSONS, B.A.

Lecturer in Zoology in the University of Glasgow

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REPORT ON PENGUIN EMBRYOS COLLECTED DURING THE DISCOVERY INVESTIGATIONS

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Text-figs. 1–9, Plates I–VI

INTRODUCTION

OUR knowledge of the development of birds is securely based on the detailed investigations that have been made of the embryology of the common fowl. Amongst an exceptionally long list of modern workers who devoted their attention to the problems involved some names stand out pre-eminently. F. M. Balfour was publishing on the subject in 1873, Duval gave us his *Atlas d'Embryologie* in 1889, Keibel and Abraham published the *Normentafel* in 1900, and in 1908 Lillie brought out his *Development of the Chick*.

The last-mentioned books give evidence of the massive research extending over twenty years on chick embryology, and it is surprising that in this period comparatively few other species of birds were the object of similar enquiries. The duck naturally had a place in the work of embryologists—next to the fowl it is the most accessible material—and of less common forms penguin embryos have been the subject of a certain amount of published work. Material brought home by the Scottish National Antarctic Expedition was worked out by Waterston and Geddes (1909), and other penguin embryos collected by the Deuxième Expédition Française were the basis of a joint report by R. Anthony and L. Gain in 1915. Their *Contribution à l'étude de l'embryologie des Spheniscidae* is devoted to three main points: (i) the development of the skeleton of the wing, (ii) the development of the skeleton of the foot, (iii) the feathering ("pterylosis").

The embryos described by Waterston and Geddes were fixed in formalin and were not in a satisfactory condition for microscopic examination in any great detail. The limitations imposed by these conditions are of course very great, and the report, as far as the embryos are concerned, deals chiefly with external features. There was therefore an urgent need for new material, and during the Discovery investigations an extensive collection of the embryos of two species of penguins was made in the course of the 1928–9 and 1930–1 seasons.

The majority of the embryos—sixty-four—were of the Gentoo penguin, *Pygoscelis papua*, from South Georgia. The remainder—fourteen—were of the Ring penguin, *Pygoscelis antarctica*, from the South Shetlands. They were obtained and preserved by Mr F. C. Fraser, the eggs being taken at random and the embryos dissected off the blastoderms by him and then fixed. He used two fixatives. In the 1928–9 season at South Georgia only the eggs of Gentoo penguins were taken and twenty-six embryos were fixed in saturated mercuric chloride and 5 per cent acetic acid solution. The excess mercuric chloride was washed out in iodine alcohol before storage in 70 per cent spirit. Thirty-eight Gentoo embryos were collected in South Georgia in the 1930–1 season, together with the Ring penguin embryos from the South Shetlands. These were preserved in Bouin's fixative and were also received in 70 per cent spirit. Both batches of material arrived in splendid condition; the corrosive-fixed embryos proved the better material for sectioning purposes, while the Bouin-fixed embryos were the better for dissection.

Owing to the method of collection there is no information about the precise length of time that any particular embryo has been incubated.

STAGES OF DEVELOPMENT

The embryos make up a remarkably complete series of stages, extending from a small Gentoo embryo 3·8 mm. in length to a large Ring embryo on the point of hatching that measures 150 mm. from the tip of its beak to the end of its tail.

The earlier stages, which are all of Gentoo embryos, bear so close a resemblance to the corresponding stages in the fowl that it will be convenient to define them in terms of the *Normentafel* of Keibel and Abraham.

1. The smallest embryo (Plate I, fig. 1) compares with a fowl of 24 hours' incubation. NT (i.e. *Normentafel*), stage 9.

Length, measured from the anterior limit of the medullary folds to the posterior limit of the primitive streak, 3·8 mm. Length of primitive streak 1000μ.

Medullary folds dilate anteriorly to an exceptional degree and widen posteriorly around the headward end of the primitive streak. The folds are not continuous behind the primitive streak as they are in *Peripatus* and *Lepidosiren* (cf. Kerr, 1919, pp. 496, 497). Number of mesoderm segments 6.

Notochord (*ntc*), visible for a considerable distance through the floor of the neural canal, terminates anteriorly in a Y-shaped split.

Fore-gut (*fg*) developed symmetrically. Extends from the headward end of the division of the notochord nearly to the level of the first mesoderm segment.

Proamnion lies in front of the head fold, and precociously developed cavities of the splanchnocoele containing fluid, at the sides of the fold, are conspicuous features of the embryo at this stage.

2. The next stage is comparable with a fowl of 48 hours' incubation (Plate I, fig. 2). NT 13. Length 5 mm.

Medullary folds closed anteriorly, head already bending towards the ventral side. Optic rudiments established. Otocysts also clearly visible. Number of mesoderm segments 18.

Heart S-shaped. Aortae (*ao*) paired anteriorly, give off right and left vitelline arteries posteriorly.

Embryonic excretory organ established in a rudimentary condition. It may be seen in transverse sections cut behind the level of the seventh mesoderm segment. The organ originates as a ridge of mesodermal cells between the mesoderm segments and the lateral mesoderm. The latter splits into the splanchnic and somatic layers and, at this stage, is united to the mesoderm segments by a narrow isthmus of cells. The excretory ridge first makes its appearance just dorsal to this isthmus. Posteriorly it is a solid rod of cells, but at its anterior end it acquires a cavity foreshadowing that of the archinephric duct.

The amnion has grown over the head and body of the embryo to the level of the vitelline veins. The exceptional distance between these veins and the vitelline arteries in the penguin embryo at this stage is one of the most remarkable differences between it and the fowl embryo of the same stage.

3. Stage comparable with a fowl of 67 hours' incubation (Plate II, fig. 1). NT 18. Length 10·4 mm., measured as though the embryo was straightened out.

Head flexed at right angles to the body, brain regions—hemispheres, optic lobes, and medulla oblongata—clearly distinguishable. Choroid fissure open. Otocyst still in contact with the surface ectoderm. Olfactory pit. Number of mesoderm segments 39.

Pharynx distorted by visceral clefts (*c*). Of these, numbers I and II perforate the ectoderm, numbers III and IV lie close to the surface but do not penetrate it. The hindgut is completed.

Rudiments of (i) the liver, and (ii) the lung. The liver rudiments arise as two pouches, one on either side of the main venous trunk as it enters the heart. The lung rudiment, arising as a constriction on the floor of the pharynx, is already divided at its hinder end into two small pouches. These come behind the last visceral cleft and extend nearly to the level of the apex of the heart. As they are simply prolongations of the enteric wall their cavities are lined with endoderm. Owing possibly to the position of the embryo, with its left side towards the mass of yolk, the left lung rudiment is retarded in its growth in comparison with the right. This inequality is of course only temporary, and in the later stages there is no obvious difference in size between the two lungs.

The heart lies within a closed pericardiac cavity. The ventricle and conus regions are clearly demarcated on the right side.

Limb rudiments have made their appearance: (*f*) fore-limb, (*h*) hind-limb.

Amnion complete. At its hind end it is attached to the serous layer by a short connective (*a*) which recalls the longer amniotic funnels figured by Schauinsland (1903) in embryos of *Puffinus*, *Phaeton*, and *Diomedea*.

Allantois rudimentary, just visible outside the body (*al*).

4. Stage comparable with a fowl of 4 days 8 hours' incubation (Plate II, fig. 2). NT 25.

Length, measured along the dorsal surface from the top of the optic lobes to the tip of the tail, 20 mm. This is about 5 mm. longer than the corresponding stage in the fowl.

Brain regions with the exception of the cerebellum are all established.

Retinal pigment appearing in the eye, separation of the lens from the ectoderm.

Otocyst deeply embedded and only indicated at the surface by a shallow depression.

Olfactory pits wide open and forming spacious cavities.

Visceral clefts III and IV still visible at the surface, numbers I and II enclosed by the overlapping hyoid arch (*hy*) which extends upwards close to the otocyst.

Umbilical stalk complete. Yolk duct opens into the intestine. Allantois well developed.

Liver bilobed: a conspicuous organ lying close to the base of the heart and occupying a large share of the available coelomic space.

Lungs pyriform. They are still simple sacs with a wide central cavity forming the main intrapulmonary bronchus (the mesobronchus). At this stage the mesobronchi are beginning to bud off channels dorsally: the ectobronchi (Fig. 1 *a*).

Pancreas: three rudiments, one situated behind the stomach region, the other two arising as pockets from the liver diverticula. It is interesting to note that the threefold origin of this gland is not always clearly indicated by three ducts in the adult penguin. Watson (1883, p. 198) records considerable variation in the number of these ducts, for example in *Eudyptes*.

Maxillary ridge (*mx*). Mandibular ridge (*m*). Limb buds (e.g. *h*) begin to show differentiation internally.

Excretory organ: opisthonephros well established. Its ducts have acquired openings into the cloaca.

5. Stage comparable with a fowl of 8 days' incubation (Plate III, fig. 1). NT 31. Length 31 mm. Brain with very prominent optic lobes. Eyes socketed in epithelium, through which lachrymal glands perforate later. Rudiment of nictitating membrane.

External auditory meatus. Olfactory organs enclosed, external nares, rudiment of the beak.

Operculum (*op*) fully developed as a backgrowth from the hyoid arch.

Stomach large, intestine short and scarcely coiled. Bile duct greatly distended forming a gall bladder of quite exceptional size.

Lungs growing rapidly and bearing at their hinder ends the rudiments of two of the air sacs: (i) the posterior thoracic air sac, (ii) the abdominal air sac. Internally the mesobronchus of each lung has budded the rudiments of eight entobronchi on the ventral side as well as the four dorsal ectobronchi. Its prolongation beyond the borders of the lung forms the rudiment of the abdominal air sac, which conceals one of the entobronchi beneath it in the example figured (Fig. 1 *b*).

Limb buds (*l*) are marked externally by the developing digits at their tips. The difference in shape between the fore- and hind-limbs is becoming clearly established.

Note. In the corresponding stage of the fowl embryo traces of feathers are apparent on the rump, on the ventral body-wall, and on the hind-limbs. There are no feather rudiments at this stage in penguins.

6. Stage comparable with a fowl of about 10 days' incubation (Plate III, fig. 2). NT 34.

Length 58 mm., including beak. Altogether about 20 mm. longer than the fowl at this stage.

Brain. Rapid growth of the hemispheres and the commencement of the growth of the cerebellum combine to change the contour of the head to a dome-like shape.

Eye. The wall of the sclera bears a number of papillae strongly recalling the sclerotic ossicles so commonly seen in the fossils of extinct aquatic reptiles and present in the sclera of many birds. In the penguin their incidence is apparently only of short duration at this stage in development. When the eyelids have grown they disappear (cf. papillae conjunctiva sclerae in the fowl, Lillie, 1908, p. 280).

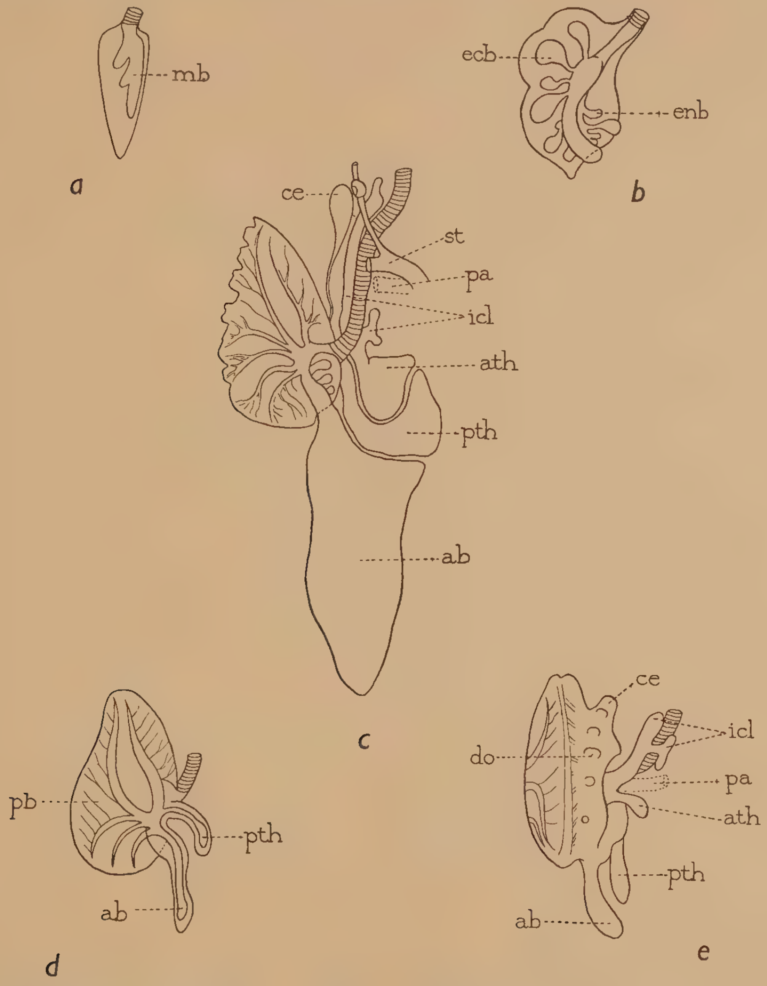

Fig. 1. The lung and air sacs. *a*, stage 25; *b*, stage 31; *c*, stage 37; *d*, stage 34. *a*, *b*, *c*, and *d*, diagrams of the right lung drawn from the right side; *e*, the same lung as *d*, dorsal view.

ab, abdominal air sac; *ath*, anterior thoracic air sac; *ce*, cervical air sac; *do*, dorsal papilla; *ecb*, ectobronchus; *enb*, entobronchus; *icl*, interclavicular air sac; *mb*, mesobronchus; *pa*, pulmonary artery; *pb*, parabronchus; *pth*, posterior thoracic air sac; *st*, systemic artery.

The external auditory meatus takes on the adult appearance.

All traces of the visceral openings on the neck have vanished. The intestine is thrown into two spirals completely enveloping the rudiments of the pancreas. The spleen develops on the omphalo-mesenteric artery.

The lung is now well developed with numerous passages radiating from the ectobronchi and entobronchi. These are the first of the parabronchi (Fig. 1 *d*, *pb*). Besides the rudiments of the posterior thoracic and abdominal air sacs, the lungs bear the processes which afterwards develop into the other three air sacs of the hatched bird—cervical, interclavicular, and anterior thoracic. In addition to these permanent air sacs, the lung buds out five other papillae on the dorsal surface at this stage, which do not persist (Fig. 1 *e*, *do*).

It has long been known that the lungs of certain of the Reptilia expand into air sacs. They are very much smaller in the chameleon for example than they are in modern birds, but they are also more numerous (Heilmann, 1926, p. 128). It is probable therefore that the additional outgrowths on the dorsal surface of the lung at this stage represent a more primitive condition.

Limb buds. Fore-limb elongating with extraordinary rapidity. The contour and character of the future flipper is plainly seen. The hind-limb is digitate with webbing between the toes.

Feathers. The first rudiments of feathers make their appearance as papillae growing in the skin of the tail region. The tongue (*t*) is visible intra-orally.

7. Stage comparable with a fowl of about 13 days' incubation (Plate IV, fig. 1). It is beyond the stages included in the *Normentafel*, and for convenience it is assigned here to stage 37. Length 85 mm., including beak. Eye protected by well-developed lids.

Feather rudiments distributed all over the body. They appear last on the fore-limbs, and the rudiments in this situation grow into feathers exactly like those that develop on other parts of the body. There is no reason to suppose, therefore, that they have ever previously been modified for the purposes of flight. In the water, indeed, the fore-limb is used entirely as a swimming organ and it seems reasonable to regard it as a flipper rather than as a wing. Its length at this stage of development in relation to the rest of the body is quite out of the ordinary (Plate V, fig. 2). The hind-limb is also disproportionately large. Webbing extends nearly to the ends of the digits and the latter are thoroughly protected at their tips by thick cushions of integument ("neonychia"—Agar, 1909, p. 374), which prevent the possibility of damage to the amnion or other delicate membranes.

Viscera. These are illustrated by dissections (Plate IV, fig. 2 and Plate V, fig. 1). A few points call for comment:

(i) The alimentary canal. The crop region (*cr*) is not really separate from the stomach. It is a characteristic of penguins that the whole of the anterior division of the canal is a continuum which is enormously distensible (Wilson, 1907, p. 43). The capacity of the fledglings for food, and the necessity the adults are under of landing sufficient for their own needs as well as for the voracious young are well known facts (Wilson, 1907, p. 44; Levick, 1910, p. 80, etc.). It is not surprising therefore to find, quite early in development, that the anterior part of the alimentary canal is exceptionally wide.

(ii) The vascular system. The heart and main blood vessels are typically avian. In the neck region the extraordinary size of the jugular vein is correlated with large dimensions of the head in comparison with the body. In the region of the abdomen the dorsal aorta gives off two allantoic arteries. Of these the left artery is well developed and the right is degenerating. A remarkable feature of the blood system at this stage is that the primitive arrangement of a double aortic root is maintained. There is no trace of the reduction in size, which takes place subsequently, of the left side of the root (Plate V, fig. 1). The duct of Botallus (*db*), i.e. the connective between the pulmonary arch and the aortic roots, is also present on both sides.

(iii) The excretory organ. The posterior segments of the opisthonephros have enlarged and grown in a headward direction dorsal to the main mass of the excretory organ. The character of the organ is therefore undergoing a change towards the purely metanephric type found in the hatched bird. The metanephric duct—the ureter—is already distinguishable (Plate V, fig. 1 *x*), but the division of the organ at the level of the allantoic artery (*ala*) does not mean a separation between the mesonephric and metanephric portions. The two parts are in organic continuity dorsally and the division probably foreshadows the groove that marks off the fully developed metanephros into two lobes. In this respect the kidney of adult penguins differs from that of the majority of birds in which there are three lobes (Watson, 1883, p. 217).

Up to this point the developmental stages have been covered by the bulk of the available material—the sixty-four Gentoo penguin embryos. For stages beyond it, right up to the time of hatching, the additional fourteen Ring penguin embryos were at hand. Fortunately the youngest of the latter coincided in development almost exactly with the oldest of the Gentoo embryos. A comparison between the two of them after dissection revealed no differences in their anatomy. The extent of the permanent air sacs, for example, in the smallest of the Ring penguin embryos, shown in Fig. 1 *c*, would serve equally well to illustrate their condition in the Gentoo embryo (Plate IV, fig. 1).

8. The anatomy of the oldest of the Ring embryos, fledged in the coat of silky down feathers with which it hatches, is represented on Plate VI, figs. 1 and 2. The first of the figures shows a superficial and the second a deep dissection. The embryo is large, about 150 mm. in length.

The most noticeable difference between this stage and the preceding one, apart from the fact that it is nearly double the size and has a complete covering of feathers, is the inclusion of the yolk sac within the body-wall of the embryo. On the hind-limb the claws are moreover uncovered, and the neonychia (*ne*) are wearing away their points. Preparation for using the claws to destroy the embryonic membranes is therefore nearly complete, and the appearance of the limb is in this respect in remarkable contrast with the protected limb of the previous stage (Fig. 2). The horny bill with its sharp-pointed egg tooth (*et*) has also undergone a great change in readiness for the act of hatching. The horn is deposited beneath the surface layer of the epidermis, the so-called epitrichium, from a specialized zone of cells. It is exposed after the epitrichium is shed. The details of the process and the histological changes leading up to it have been described from a series of embryo *Eudyptes* by Max Lewin (1903) and they apply equally well to the Ring penguin.

The cartilaginous skeleton at this stage is rapidly undergoing replacement by bone. Ossification of the chief elements of the axial skeleton is proceeding and to some extent also replacement of the basic cartilages of the skull.

The brain, with the completion of the cerebellum, takes on the aspect and proportions of that of a typical bird.

The eye, as shown in Plate VI, fig. 2, develops a large pecten (*pe*) on its floor and the eyelids close. The pecten in most birds is single, and it first arises in the penguin as a simple lamellate process. By the time the embryo is ready to hatch, however, this sheet of tissue is divided into ten units (the teeth of the comb) which adhere to one another only by their tips (Fig. 3 *a*).

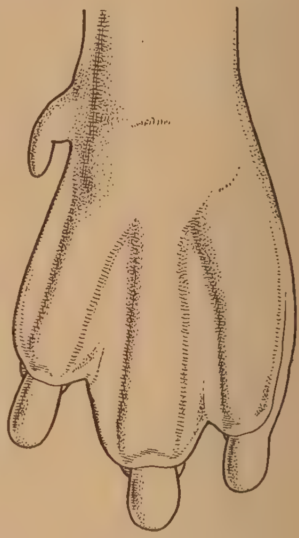

Fig. 2. Left hind-limb, Gentoo penguin embryo, stage 37 (Plate IV).

With regard to the viscera, the stomach lies on the left side of the body and the much-coiled intestine is thrust dorsally and to the right side of the coelomic cavity by the yolk sac. The rectum opens into the cloaca, which receives the metanephric ducts (Plate VI, fig. 2, *x*), genital ducts (Plate VI, fig. 2, *y*), and the bursa Fabricii. At the earlier stage (Plate V, fig. 1) the bursa (*bf*) is a sac of large dimensions. It has dwindled in proportion very considerably by the time hatching is imminent. Rudiments of both gonads, with their ducts, are present in these later stages of the development, although in penguins, as in other birds, the right ovary and right Müllerian duct are atrophied in the adult.

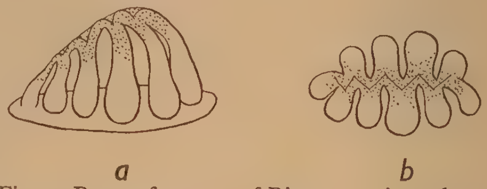

Fig. 3. Pecten from eye of Ring penguin embryo on the point of hatching (Plate VI). *a*, elevation; *b*, plan.

The large proportions of the gall bladder in relation to the liver is illustrated in Plate VI, fig. 1, *gb*. It is rather puzzling to explain the excessive secretion of bile that this indicates. It may be associated with the habit of bringing large food supplies ashore in the breeding season and of feeding the young with partly digested chyme. To accomplish this the parents open their bills and the young thrust in their heads as far as they can (Murphy, 1915, p. 120; Matthews, 1929, p. 587). On the other hand, it may have a purely physiological significance. The food taken is chiefly composed of Euphausians and Cephalopods. Both have a high percentage of fat, for the hydrolysis of which in large quantities during digestion an abundant supply of bile salts may be necessary.

In Plate VI, fig. 2, the lung is indicated by a dotted line and the blood vessels on the dorsal side of it are drawn as if they were seen through it. It is interesting to note that even at this late stage both right and left aortic roots remain in full operation in the supply of blood to the dorsal aorta (Plate VI, fig. 2, *ar*). The persistent left umbilical vein (Lillie, 1908, p. 368) was dissected from the mid-ventral line and is drawn (Plate VI, fig. 1, *uv*) pulled over to the left side with a piece of the body-wall to which it was attached. The latter is cup-shaped because it enveloped a protuberance on the ventral side of the yolk sac.

COMPARATIVE STUDIES IN DEVELOPMENT

THE BRAIN

This commences in penguin embryos, as in most other vertebrates, with the formation of longitudinal medullary folds. They are wider apart both anteriorly and posteriorly than the corresponding stage in the development of the fowl. The medullary folds quickly unite to form a neural tube out of which the compartments of the brain differentiate. By the time stage 31 is reached, i.e. NT 31, the hemispheres, optic lobes, and

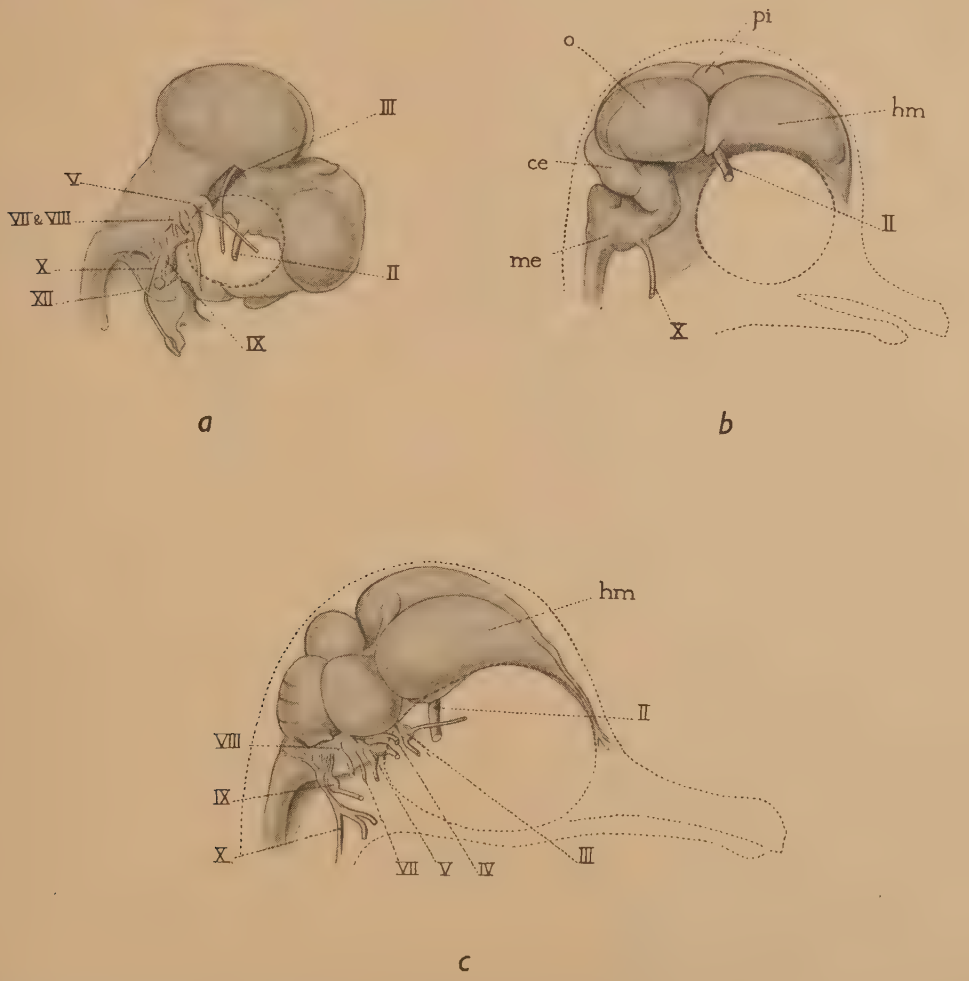

Fig. 4. Right side of the brain of Gentoo penguin embryos: *a*, stage 31; *b*, stage 34; *c*, stage 37, drawn from the brain of a Ring penguin embryo.

ce, cerebellum; *hm*, hemisphere; *o*, optic lobe; *me*, medulla oblongata; *pi*, pineal body; I–XII, roots of cranial nerves.

medulla oblongata are established, and on the roof and floor respectively of the thalamencephalon the pineal and pituitary bodies can be clearly discerned. The roots of most of the cranial nerves may also be found by dissection (Fig. 4 *a*).

Between stages 31 and 34, the hemispheres grow rapidly and encroach on the region of the thalamencephalon. They develop in association with the olfactory sense organs at the time when the beak itself is elongating most noticeably (Fig. 4 *b*). Meanwhile the cerebellum (*ce*) makes its appearance behind the optic lobes. At first it is little more than a ridge, and it develops late, as might be expected of an organ particularly connected with the control and perception of fine movements.

Further increase in the size of the hemispheres and of the cerebellum results in the disposition of the main regions of the brain as illustrated in Fig. 4 *c*. The cerebellum, now prominent, is divided by three sulci, the hindmost of which demarcates a broad basal segment bearing a pair of lateral processes known as the flocculi. These are particularly clear at this stage (cf. the dorsal view of the brain shown in Fig. 5 *b*), and they are protected in a special recess which develops on the inner wall of the auditory capsule. The close association of processes of the cerebellum with the otocyst in development may have some functional significance, in view of the future relations of both organs to movement. It is also noteworthy that in Crocodilia, the only reptiles which have the cerebellum at all well developed, two sulci may be distinguished; and in them again the basal segment of the cerebellum bears a pair of flocculi (Heilmann, 1926, p. 108).

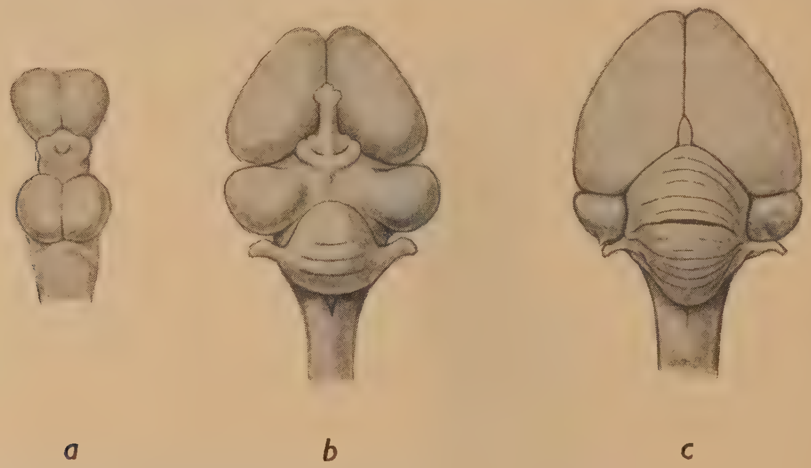

Fig. 5. Dorsal surface of the brain. *a*, of a Gentoo penguin embryo, stage 25; *b*, of a Ring penguin embryo, stage 37; *c*, of a Ring penguin embryo on the point of hatching (Plate VI). Scale: *a* × 6, *b* × 3½, *c* × 2½.

At the time of hatching (Fig. 5 *c*) the cerebellum has grown to such an extent that it forms with the hemispheres the main mass of the brain. The effect of this growth is to push aside the optic lobes permanently, and the surface of the cerebellum becomes marked by numerous sulci. This surface sculpturing makes a strong contrast between the cerebellum and the hemispheres. The latter remain perfectly smooth without any trace of convolution, and wedged in between them and the cerebellum may be seen the tip of the pineal body.

The pineal body develops precociously in the penguin. It is a short process of the roof of the thalamencephalon as early as stage 25, with a ring of nervous tissue surrounding it which forms the habenular ganglion. The appearance of the brain as a whole at this stage (Fig. 5 *a*) recalls that of the poorly developed brain of the lamprey. The hemispheres and the optic lobes in both cases are almost of equal size, and the pineal bodies on the dorsal surface of the two brains strikingly resemble one another.

In the stage figured in Fig. 5 *b*, the glandular tip of the pineal body is shown free from the surface of the brain. It has developed a large peduncle and its size is temporarily disproportionate to the rest of the brain. In this way it anticipates the subsequent growth of the hemispheres and cerebellum (Fig. 5 *c*) and retains its position on the dorsal surface of the fully developed brain. In its later stages the organ undergoes considerable degeneration and does not at any time show traces of eye structure.

THE FEATHERS

Feather papillae first show themselves in the skin of the tail (stage 34, Plate III, fig. 2, *rt*). According to Anthony and Gain (1915, p. 22) the later papillae arise in isolated feather tracks which spread and fuse with one another as development proceeds. It is a remarkable fact that the last feather rudiments to appear are those which occur on the wings.

In actual distribution the feathers of penguins are unique. They occur uniformly all over the body in the adult and only one apterium persists (Pycraft, 1907, p. 2). In the embryo, naturally, this exceptionally complete coat of feathers is preceded by an equally complete covering of feather papillae (cf. Plate IV, fig. 1). But between the definitive feathers and the papillae there intervene no fewer than two generations of nestling down (Pycraft, 1907, p. 11). The embryo hatches with the first of these, and with their development from the papillae the following observations are alone concerned.

A fragment of skin bearing feather papillae and filaments was dissected from the wing of the youngest Ring penguin embryo. It will be remembered that this embryo was at approximately the same stage of development as the Gentoo embryo figured on Plate IV, fig. 1. The piece of skin was drawn (Fig. 6 *a*) and sections were then cut longitudinally and transversely through the papillae and also through the filaments. The sections through the papillae (Fig. 6 *b*, *c*) show the thickened epidermis overlying a dermal layer which is condensed in the region of each individual papilla to such a degree that it has an almost granular appearance. In the epidermis Wohlauer (1902) made out three different types of cell: (i) a surface layer of flattened cells forming the "epitrichium", (ii) a layer of intermediate cells, and at the base (iii) a layer of cylindrical cells which may or may not be double. The same sequence of epidermal layers is characteristic of the early stages in the development of the normal reptilian scale (cf. Kerr, 1919, p. 71), and the view that feathers can be derived from conical papillae of this type is therefore well founded (Boas, 1931, p. 563). There are strong arguments, however, against the opinion that the feathers are in fact to be regarded as modified scales. These are set out elsewhere (e.g. Pycraft, 1907, p. 3; Ewart, 1921, p. 634, etc.), and the controversy remains unsettled. It would seem sufficient, and certainly it would be in accord with the facts, to regard the granular type of skin reproduced in the earliest feather papillae as being a likely characteristic both of the ancestors of birds and of the scaly reptiles. Just such a skin as this is still found in some of the more primitive lizards, e.g. chameleons.

The papillae give rise to filaments by a process of exaggerated growth (Fig. 6 *d*). The dermal element retains its granular appearance peripherally but has now in addition a central pulp cavity in which there are numerous blood islands (Fig. 6 *e*, *pc*).

For the next step in development the skin of an older embryo is necessary. A suitable fragment is illustrated in Fig. 6 *f*.

When the longitudinal and transverse sections of one of these filaments are compared (Fig. 6 *g*, *h*), it is at once evident that the further increase in length of the feather filament has been accompanied by changes both external and internal. The external changes result in the formation of a horny sheath, the internal in the isolation of eight solid epidermal masses which are the rudiments of the barbs of the down feather. The dermis plays no part in the construction of the feather other than that of supplying the vascular requirements of the early stages and a formative zone for the epidermis. The boundary between the two layers, as Wohlauer showed, is set up in the later stages of development by the cylindrical epidermal cells. The middle layer of intermediate cells form the barbs, and the outer cells make up the sheath.

Just about the time when the embryo is due to hatch the sheath of the feather filament disintegrates. Its loss releases eight barbs, which thereupon fluff out producing the complete feather. In preparation for this event each of the barbs pushes out lateral processes, or barbules, which therefore also arise in the intermediate cell layer. In section they are seen intervening between the solid cell masses forming the barbs and the surrounding sheath. Fig. 6 *i* was drawn from a fragment of the skin of the oldest of the series of Ring penguin embryos. In this one of the feather filaments has lost the outer sheath so as to free the barbs. Fig. 6 *j* shows a longitudinal section through the base of such a filament, and *k* a transverse section at the same stage cut far enough away from the surface of the skin to show barbules as well as barbs.

A further point concerning feather development deserves attention. It will be seen that the filaments become deeply embedded in the dermal tissue and reach down to the level of the subcutaneous musculature. This ensures a considerable degree of muscular control, an obvious necessity for a homoiothermic animal which relies largely on such outgrowths of the epidermis for the conservation of heat. It will also be observed that each filament has, on one side of it or the other, an attendant surface papilla (Fig. 6 *f*, *fp*). These have exactly the same composition as the original feather papillae, but though so closely connected with the filament they are not included in its sheath. It seems probable that these are the rudiments of the filoplumes (Ewart, 1921, p. 626), which are retarded in development amongst the down feathers but are nevertheless known to be present in the adult (Pycraft, 1907, p. 3).

In addition to these papillae each feather filament is encircled by still smaller papillae of the same kind, which are less regularly distributed (Fig. 6 *f*, *pl*). Exactly comparable

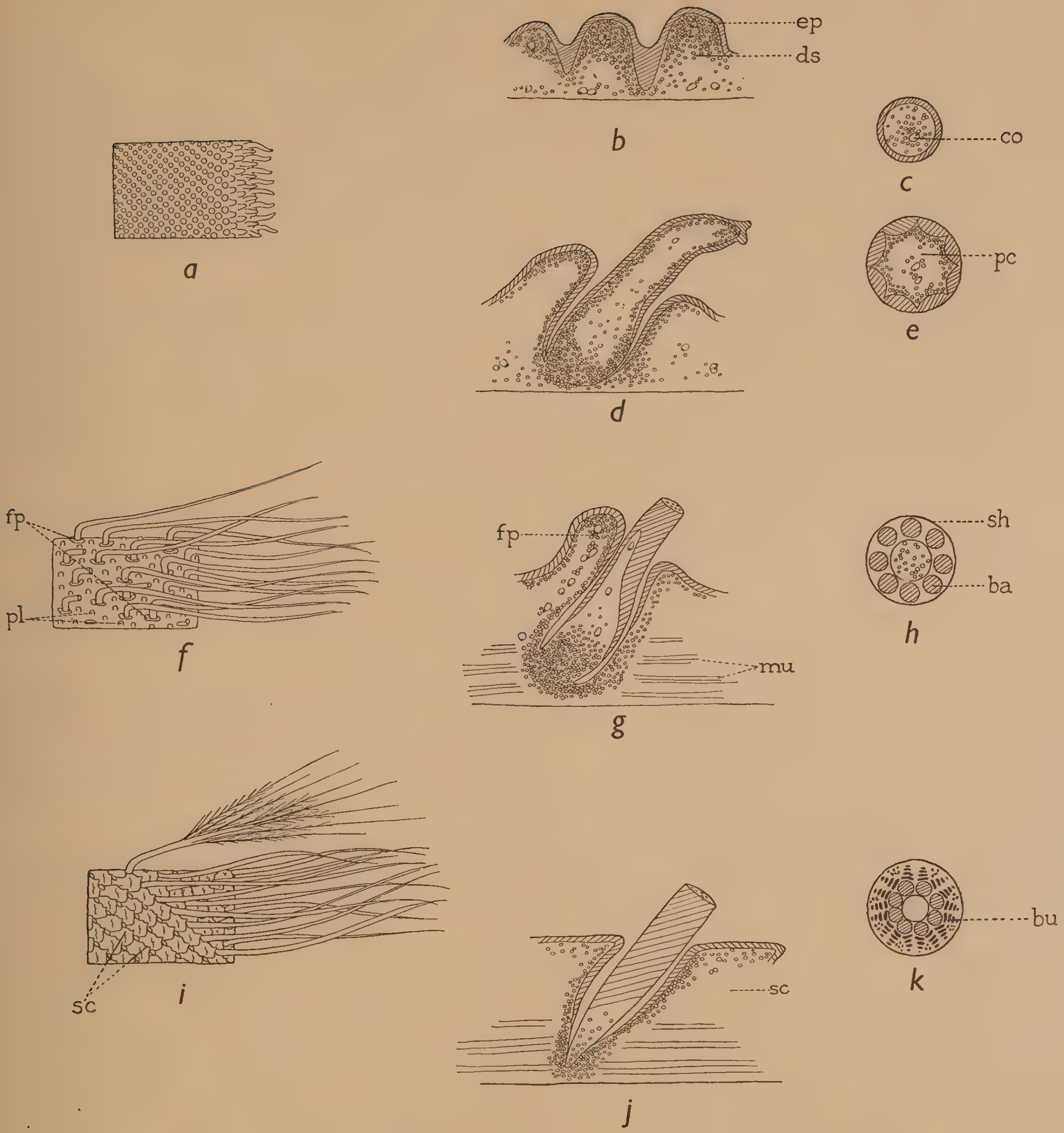

Fig. 6. Development of down feathers: diagrammatic.

a, skin fragment, Ring penguin embryo, stage 37; *b*, longitudinal section of feather papillae; *c*, transverse section of a feather papilla; *d*, longitudinal section of a feather filament at this stage; *e*, transverse section of the same.

f, skin fragment, Ring penguin embryo, approximately half-way through the incubation period; *g*, longitudinal section of a feather filament at this stage; *h*, transverse section of the same.

i, skin fragment, Ring penguin embryo, at the close of the incubation period; *j*, longitudinal section of the base of a feather; *k*, transverse section at a higher level, to show barbules.

ba, barb; *bu*, barbule; *ds*, dermis; *co*, blood corpuscle; *ep*, epidermis; *fp*, filoplume; *mu*, muscle; *pc*, pulp cavity; *pl*, papillae; *sc*, "scale"; *sh*, sheath. (Transverse sections after Wohlauer.)

structures may be seen in the skin of an embryo duck of about fourteen days' incubation (Lamont, 1922, p. 234). They are stated to be the forerunners of the true down, while the large feather filaments are said to give rise to the natal down which precedes the development of the true feathers.

In the penguin the subsequent history of these small papillae is different. They are no longer visible at the surface by the time the embryo is ready to hatch, and no traces of them are to be found in sections of the skin. Even if they actually abort, their temporary presence is of great interest in view of the fact that the epidermis, over which they are scattered, splits up later into a regular pavement of soft scales between the feather filaments (Fig. 6 *j*, *sc*). They clearly grow independently of the "scales", since they precede them, and as their numbers are greater they are not to be regarded as the precursors of the individual "scales".

THE CARTILAGINOUS SKELETON

This was investigated in the early stages of development by means of the Victoria blue staining method for cartilage (van Wijhe, 1902, 1922). Fixation in formalin is necessary for the successful application of this stain, and therefore only the Bouin-fixed material was suitable for its use. The result of using the method on four different stages of the Gentoo embryos is illustrated in Fig. 7. The stages are: *a*, stage 22; *b*, stage 26; *c*, stage 31; and *e*, stage 34. It will be seen that at stage 22 practically no cartilage is laid down. The stain picked out, however, the track of the future vertebral column and it must be presumed that the first cartilage is deposited there.

More is seen in stage 26 (Fig. 7 *b*). In the head region the mass of cartilage in the vicinity of the otocyst, the rudiment of the quadrate and an already strongly developed cartilage supporting the lower jaw (Meckel's cartilage), are all clearly made out. In the body the first cartilages of the limbs make their appearance, namely those that form the scapula, coracoid, humerus, radius and ulna of the fore-limb; and the femur, tibia and fibula in the hind-limb.

Having once started the cartilaginous skeleton is rapidly built up; for by the time stage 31 (Fig. 7 *c*) is reached many additional elements have been laid down. With the development of the beak the premaxilla can be distinguished from the mass of cartilage at the front of the orbit, and continuous with it there runs posteriorly a bar of cartilage out of which is built the interorbital septum—the mesethmoid—and the orbitosphenoid. Immediately behind the orbit is the rudiment of the alisphenoid, a cartilage perforated by the foramen of the fifth cranial nerve. It is temporarily in the shape of an inverted Y, and between the two arms of the Y nearest the back of the head lies the otocyst already firmly enclosed by periotic cartilages. One arm of the alisphenoid passes under the quadrate and makes contact with another similar cartilage, bearing a foramen, the exoccipital.

In the body the most conspicuous change lies in the development of some of the digital elements of the rapidly growing limbs. Their exact succession has been carefully described by Anthony and Gain (1915), and little need be added to the subject here. It is, however, interesting to observe that digits 2 and 3 make their appearance first in the fore-limb, and in the hind-limb digits 3 and 4. Moreover in the latter, the digits have each two cartilages at this stage and metatarsals 2, 3, and 4 are quite well developed. In the fore-limb metacarpals 2 and 3 may be identified.

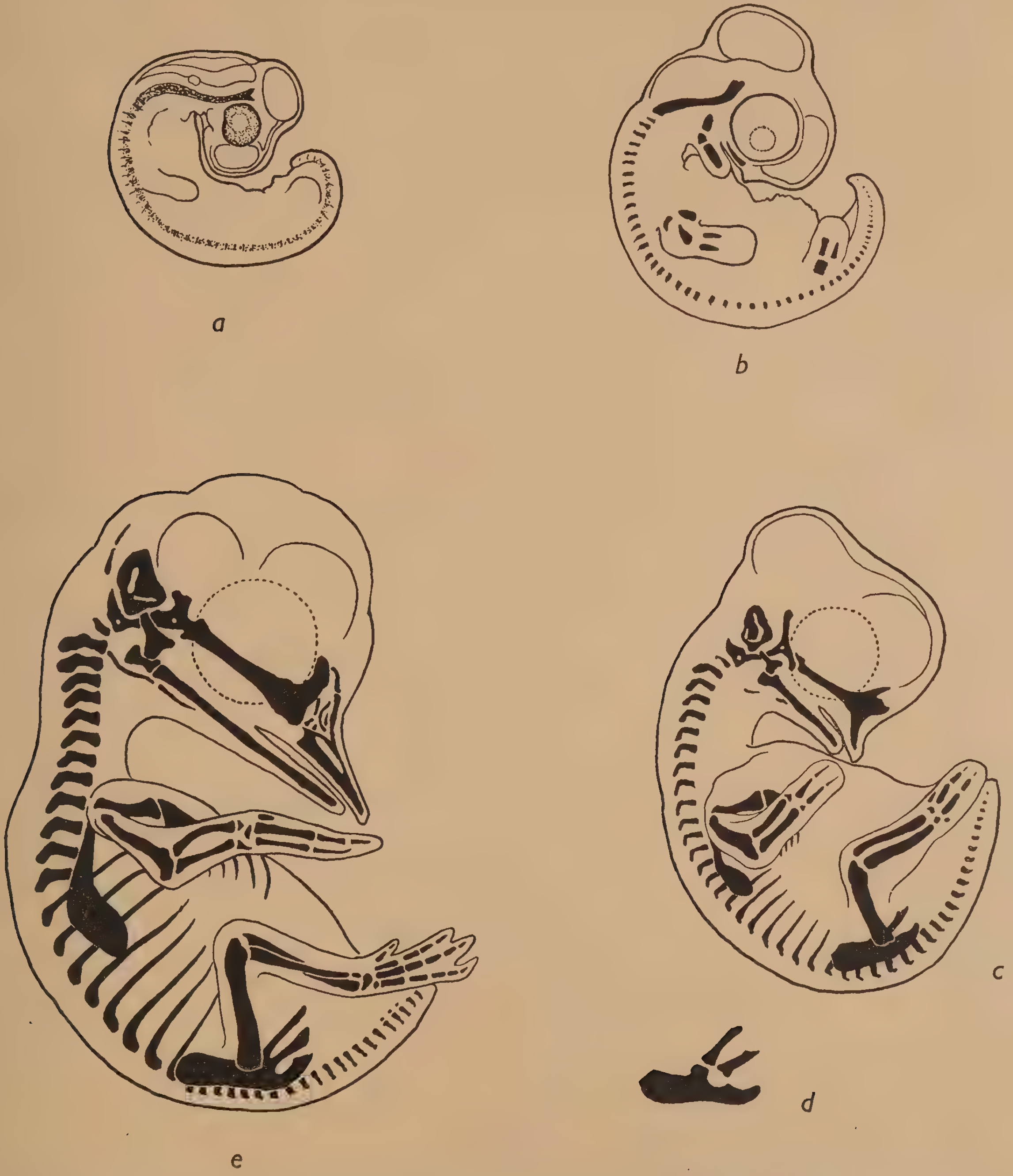

Fig. 7. The cartilaginous skeleton, cartilages shown black. *a*, stage 22; *b*, stage 26; *c*, stage 31; *e*, stage 34; *d*, pelvic girdle, stage 31. Scale: × 5.

The pectoral arch has added to it a sternum and the beginnings of sternal ribs. The pelvic girdle is built up by the union of three separate cartilages, the rudiments of the ilium, ischium, and pubis respectively. Owing to the position of the limb this point is not clear in Fig. 7 *c*, and the girdle has therefore been drawn separately in Fig. 7 *d*. In penguins, as in other birds, the pubis takes part in the formation of the acetabulum (Männich, 1903, p. 29), and it is clear that it rotates in development into a position parallel with the ischium, in the manner discussed by Goodrich (1930, pp. 206–12).

Between stages 31 and 34 (Fig. 7 *e*) no great changes occur in the cartilages other than growth. A few additions are made to their number. In the head, for example, the supraoccipitals make their appearance just dorsal to the otocyst, and the articular separates from Meckel's cartilage. Two hyoid cartilages are developed under the lower jaw close beneath the articular. They are just visible in stage 31, but they keep pace with the development of the tongue and are not prominent while the beak is small. The premaxilla becomes shifted forwards during the active growth of the beak so as to be separated from the mesethmoid. It takes the external nares with it, and in the space developing between it and the mesethmoid a number of frail ethmoid cartilages are laid down.

Most of the cartilages of the appendicular skeleton are complete by stage 34. In the flipper the first digit is represented, and in the hind-foot a small two-jointed hallux grows on the inner side. The metatarsals of digits 2, 3, and 4 are quite separate and, owing to the position of the limb, the normal tendency of the fibula to cross over from the outer to the inner side of the leg is accentuated.

Leaving the Victoria blue material one other preparation is figured with a view to showing the cartilages, especially of the limbs. This specimen (Plate V, fig. 2) was the last of the Gentoo embryos. The cartilages were exposed by peeling off the skin and muscles, a task rendered easier because the tissues were rather brittle after fixation in corrosive acetic. Two striking features of the cartilages at this stage are (i) the great breadth of the scapula, and (ii) the firmness and extent of the completed pelvic girdle.

The broad scapula is especially characteristic of the genus *Pygoscelis* (Watson, 1883, p. 25) but, in comparison with normal flying birds, all penguins have an exceptionally wide shoulder blade. This of course is a well-known feature of the skeleton of many other aquatic vertebrates and may almost be regarded as an indication of the use of the fore-limbs as organs of propulsion through water. The powerfully developed pelvic girdle of these birds is no doubt correlated with their upright gait on land. It is common knowledge that they prefer this slow method of progression to lying prone and moving fast with the help of the wings as well as of the legs. Other points of interest about the skeleton include: (i) the large size of the patella, (ii) the early development of the uncinate processes of the ribs, (iii) the presence of two extra sesamoids, just indicated in the swollen brachial tendon, (iv) the commencement of the replacement of the cartilages by bone (indicated in the figure by the little granular areas in the centre of the long cartilages), and (v) the advanced state of the development of the clavicle. This latter of course is not preformed in cartilage at all: it is not a replacement bone, and it is remarkable that while ossification in the cartilages is only beginning, the clavicle, a comparatively unimportant bone, should be so far advanced.

THE HEART

The early development of the heart of the penguin follows the usual course. It is laid down as a simple tube of splanchnic mesoderm enclosing a thin endocardiac lining. At a stage comparable with a fowl embryo of about 46 hours' incubation, stage 12, the cardiac tube seen from the ventral side is a simple bladder-like vessel, narrowing anteriorly and slightly bent upon itself (Fig. 8 *a*). By stage 13 the tube has taken on the familiar S-shaped bend of the heart of a forty-hour fowl (cf. Hochstetter, 1906, p. 38). The flexure of the tube is due to its rapid increase in length within the confined space of the pericardiac cavity (cf. Kerr, 1919, p. 370), and the increase in diameter of the hinder end of the tube, where it receives the great vitelline veins, is reflected in the dominant appearance of this part of the heart when it is seen from the ventral surface (Fig. 8 *b*).

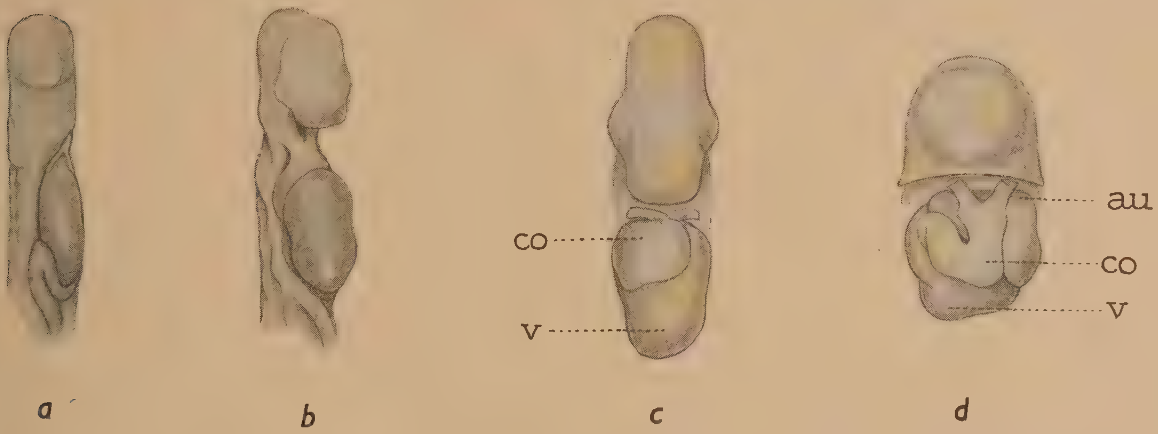

Fig. 8. The heart, ventral view. *a*, stage 12; *b*, stage 13; *c*, stage 18; *d*, stage 24. In *d* the head is cut away to the level of the optic lobes in order to expose the heart. *au*, atrium; *co*, conus arteriosus; *v*, ventricle.

In side view, the flexure is plainer (Fig. 9 *a*). Sections of the heart at this stage show that in their active proliferation the cells of the endocardium keep pace with the growth of the myocardium. They are more active in growth in the localities where the heart is least affected by the flexure.

The next stage in the development of the heart, illustrated in Figs. 8 *c* and 9 *b*, was drawn from an embryo at about stage 18. It compares therefore with the heart of a fowl of 67 hours' incubation. In the intervening period between this stage and stage 13 the heart has undergone profound modification. The centre of the cardiac tube has grown extensively, forming the ventricle, and its fixed anterior end has come prominently into view in the mid-ventral line and forms the conus arteriosus (Fig. 8 *c*, *co*). The other end of the cardiac tube, the atrial part, remains on the dorsal side of the ventricle. Its cavity is not divided until a later stage, but the opening into it from the vitelline veins is guarded by a well-developed valve. The endocardium between the atrial and ventricular parts of the heart has thickened, and in the conus localized swellings of this lining indicate the presence of three separate endocardial ridges.

In stage 24, Fig. 8 *d*, the conus has undergone an apparently independent flexure. This is not paralleled in the development of the heart of the fowl and it seems to be of the same nature as the N-shaped flexure that develops temporarily in the conus of reptilian embryos (cf. the heart of an embryo crocodile, Kerr, 1919, p. 391). At this stage the proportions of the conus indicate its importance as a chamber of the heart. At the headward end its cavity is practically divided into two by the approximation of two of the endocardiac ridges. At its base three endocardiac cushions continuous with the ridges form the rudiments of pocket valves that later develop in that region. With regard to other chambers of the heart the interauricular septum begins to form, and between the atrium and ventricle a partial septum is laid down. The atrio-ventricular opening is bounded by two thick endocardiac cushions which serve as atrio-ventricular valves.

Lastly Fig. 9 *c* shows the side view of the heart of a penguin embryo at stage 31. This is comparable with a fowl of 8 days' incubation and represents at least four full days' advance beyond the heart last described.

In the interim the septa of the conus, the ventricle, and the atrium pass through the chief phases of their development and the heart attains practically to its adult condition.

The conus septum isolates the pulmonary from the aortic cavities. At the same time the muscular conus wall begins to be incised along the line of the internal septum and the separation between the pulmonary and aortic roots commences. In the adult heart the entrance to the conus from the ventricle is guarded by a circle of three pocket valves, and a similar circle of three pocket valves also occurs at the entrance to the pulmonary artery. The relation of these valves to the original three endocardiac ridges is therefore a matter of considerable interest. In the fowl (Lillie, 1908, p. 352) the aortic and pulmonary trunks each receive one of the three primary ridges. The remaining primary ridge splits: one half passes into the aortic trunk and the other half into the pulmonary trunk. Provision is thus made for four of the future pocket valves. The other pair of valves—the third valve in each trunk—arise from specially developed secondary endocardiac ridges. In penguin embryos the course of development of the conus valves is identical with that described for the fowl.

With regard to the atrial and ventricular septa, they are discontinuous from the very beginning. The atrial septum originates in the myocardium, forming the inner surface of the atrial wall, and the ventricular septum is derived from that of the ventricle. Thus the latter develops in association with trabeculae and is at first a meshwork of muscular fibres. As the septa grow in length the atrio-ventricular opening constricts into two and they finally unite with the bridge of tissue that partitions this opening. In this way the division of the heart into four quite separate compartments takes place, the auricles and ventricles come into being, and the heart takes on the characteristic appearance seen in stage 31, Fig. 9 *c*.

One further point remains to be mentioned. In the complete heart the auriculo-ventricular openings are both provided with important valves. The pair on the right side are muscular sleeve-like structures which develop from the endocardium of the original atrio-ventricular opening, while on the other side of the interventricular septum three valves are formed in continuity with the wall of the ventricle itself. They have thus the appearance of cordae tendinae, with tasselated ends free and bent inwards towards the cavity of the left ventricle.

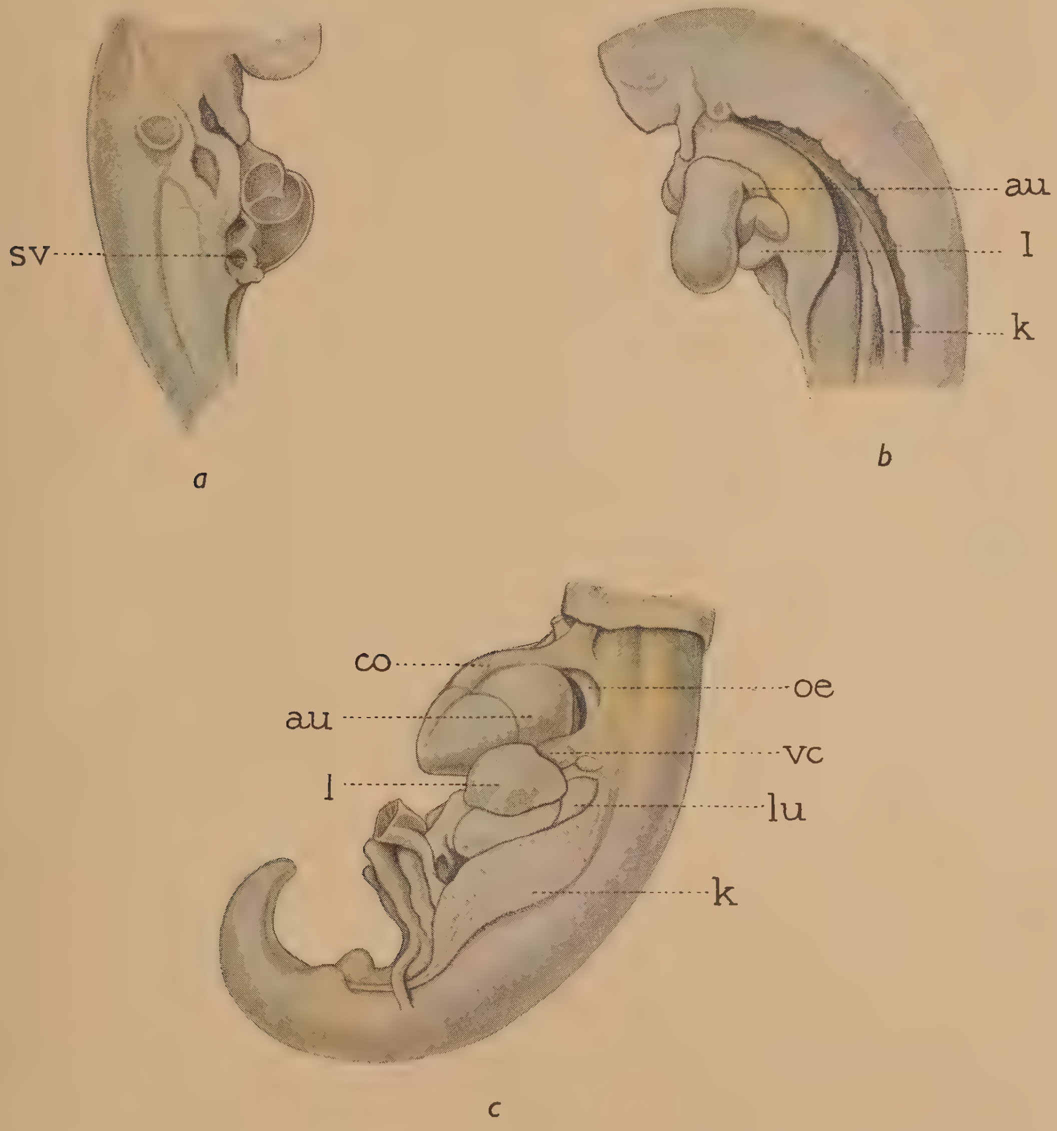

Fig. 9. The heart and associated organs, side view. *a*, stage 13; *b*, stage 18; *c*, stage 31. *au*, atrium; *co*, conus arteriósus; *k*, opisthonephros; *l*, liver; *lu*, lung; *oe*, oesophagus; *sv*, sinus venosus; *vc*, left anterior vena cava.

DISCUSSION

If the main features of the development of these penguins are reviewed certain points are outstanding. The first is the close similarity between the early stages of their development and those of other birds. Compared with the fowl the only conspicuous differences are due to the greater absolute bulk of the penguin embryo in some of the stages independent of the yolk.

The embryos are obviously penguins after probably one-third of the incubation period. The fore-limb, the webbed hind-limb, the powerful beak and the development of feather papillae all over the surface of the skin, are all characteristic.

There are not many special peculiarities in the development. The pineal body is developed in the early stages to an exceptional degree, and the thymus gland is disproportionately large at the time when feather filaments first make their appearance. The history of the feathers seems to show that they are of a very primitive type. The skin itself is very scale-like, and the heart at one stage has a reptilian flexure. But in more fundamental features the development follows the normal course and does not provide evidence of the sort that will settle the debatable problem of the true position of penguins in the class Aves. Are they specialized for their very isolated manner of life, or are they a primitive stock? On this question it was hoped that the embryology would supply a final answer. It has in fact failed to produce irrefutable evidence one way or the other, but it has supplied some new and suggestive hints. The embryos fail to produce any sign of teeth, for example, but they do develop a most peculiar pair of fore-limbs. The buds when they first arise are not exceptional, but as soon as the cartilages begin to appear in them they grow at a prodigious pace. Long before the embryo is ready to hatch, before even it assumes its coat of pre-natal down, the limbs have completed their development as far as the skeleton is concerned. It is surely not an accident that this should occur. The appearance of the trunk, with the limbs hanging vertically and the back arched, as in Plate V, fig. 2, is extraordinarily reminiscent of the aquatic reptiles of the Mesozoic Age. The whole body of the embryo at this stage is that of a creature specially adapted, with long paddles, for an aquatic habit of life, and if this adaptation—so early in development—is not merely a coincidence, it may be regarded as supporting the opinions of those who do not agree that it is reasonable to regard the penguin as simply a flying bird that took to water.

The opposite view, that the avian stock actually arose from aquatic fish-eating reptiles, and that penguins were probably an early offshoot of them that never succeeded in getting into the free air (Kerr, 1919, p. 453), has not as yet attracted many followers. It is nevertheless an idea admirably suited to the record of the primitive characteristics of both adult and embryo penguins. The adult characters of (i) a generalized type of skeleton, especially in the hind-limbs, and (ii) an unvaried type of plumage, have been discussed often enough. The suggestive points that have arisen in the course of the study of their embryology have been mentioned. There is, however, one special feature of the development that offers new light on the problem. It is concerned with the small papillae which make a transitory appearance on the dorsal side of the lung at stage 34 (Fig. 1 *e*, *do*). They are undoubtedly incipient air sacs which do not proceed with their development; and in considering the possible reasons for their disappearance the whole question of the function of air sacs in relation to an aquatic life arises. The ability to give additional buoyancy to their possessor would be of great value to a surface-swimming animal such as an aquatic reptile. It would ensure rapid return to the respiratory medium after fishing in moderate depths and, in addition, supply a necessary air reservoir to enable the animal to stay beneath the surface for a considerable time. As soon as the muscular effort of the pursuit of prey under water relaxed, the main lung—with the considerable assistance of the air sacs—would operate in bringing the predator to the surface. In doing this, however, any air sacs on the dorsal side of the lung would be hemmed in between the distended lung and the unyielding dorsal wall of the coelomic cavity, and in time—their usefulness being unexploited—they would be eliminated. This, perhaps, is the meaning of the appearance of dorsal papillae on the lung of a developing penguin for a brief time, and if so, they may be accepted as evidence that the bird developing them is in fact a primitive form.

SUMMARY

The development of *Pygoscelis* has been described from a very complete series of embryos of two species, *Pygoscelis papua* and *Pygoscelis antarctica*. The material consisted of a collection of 78 embryos with the following characteristics:

Species	Characteristics	Number of specimens
Pygoscelis papua	Open medullary folds	2
	Incomplete amnion	19
	Limb rudiments just apparent	8
	Head flexure maximal	10
	Beak rudimentary	18
	Feather papillae restricted in distribution	6
	Feather rudiments uniformly distributed	1
Pygoscelis antarctica	Feather rudiments uniformly distributed	1
	Fully fledged in pre-natal down	13

The developmental stages have been correlated with the standard stages of the fowl as fixed by Keibel and Abraham's *Normentafel*.

The general anatomy of each of the stages has been examined and the more outstanding features reported. Particular attention has been paid to the following topics: the development of the lungs and air sacs; the brain; the feathers; the cartilaginous skeleton; the heart. Other special features to which shorter reference has been made include: (i) eye structure with reference to the pecten, (ii) the skin and claws, (iii) the digestive organs, (iv) the organs of excretion.

The close similarity between the course of development of the viscera in the penguin as compared with the fowl has been demonstrated. Where differences exist they are differences of detail only (e.g. the double aortic root is persistent for a longer time; the gall bladder develops into an organ of much greater proportions than that of the fowl at the same stage, etc.).

With regard to the configuration of the body as a whole, and the underlying details of the skeleton, the very early adaptation shown for an aquatic habit has been stressed, and the contribution that penguin embryology has made to the question of the position of these birds in relation to the avian stock has been discussed.

ACKNOWLEDGMENTS

My most grateful thanks are due to Professor Graham Kerr, whose unfailing interest in the progress of this work and whose helpful criticisms of it have been a constant encouragement to me.

The work of the artists who have been responsible for the illustration of the report is an eloquent testimony to my indebtedness to them. Six of the figures in the Plates and one text-figure (Fig. 2) are reproduced from drawings by Mr A. Kirkpatrick Maxwell. All the remaining Plates and text-figures have been made for me by Miss C. Brown Kelly, to whose enthusiasm for work in a new medium I must pay special tribute.

Finally I have to thank the Discovery Committee for the opportunity of examining their material, and Mr F. C. Fraser in particular for his skilful collection and preservation of it.

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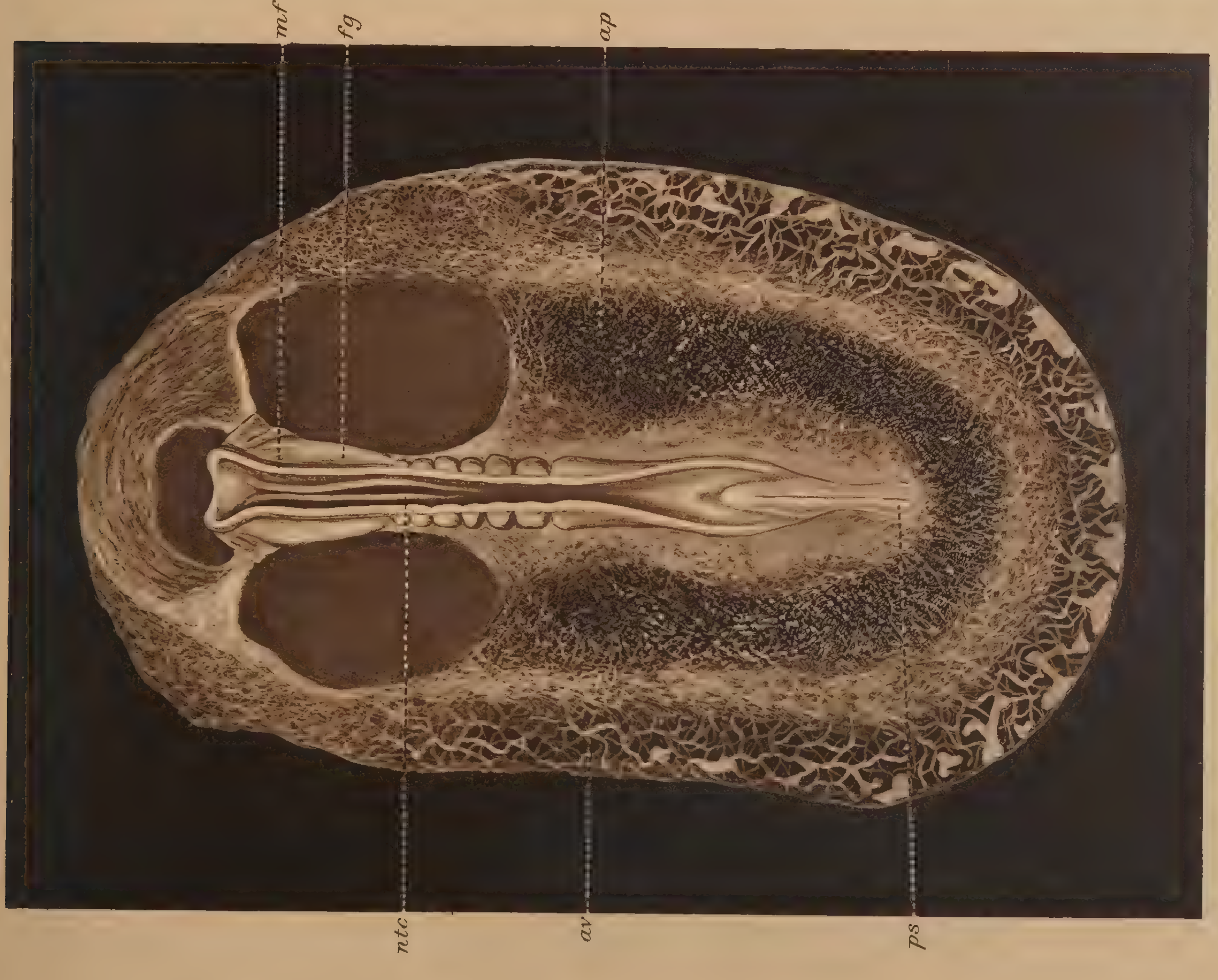
PLATE I

Pygoscelis papua.

Fig. 1. Embryo, stage 9 (No. 1). *ap*, area pellucida; *av*, area vasculosa; *fg*, fore-gut; *mf*, medullary fold; *ntc*, notochord; *ps*, primitive streak.

Fig. 2. Embryo, stage 13 (No. 2). *ao*, aorta; *le*, left eye; *ms*, mesoderm segment; *nt*, neural tube; *ot*, otocyst; *re*, right eye; *va*, vitelline artery; *vv*, vitelline vein.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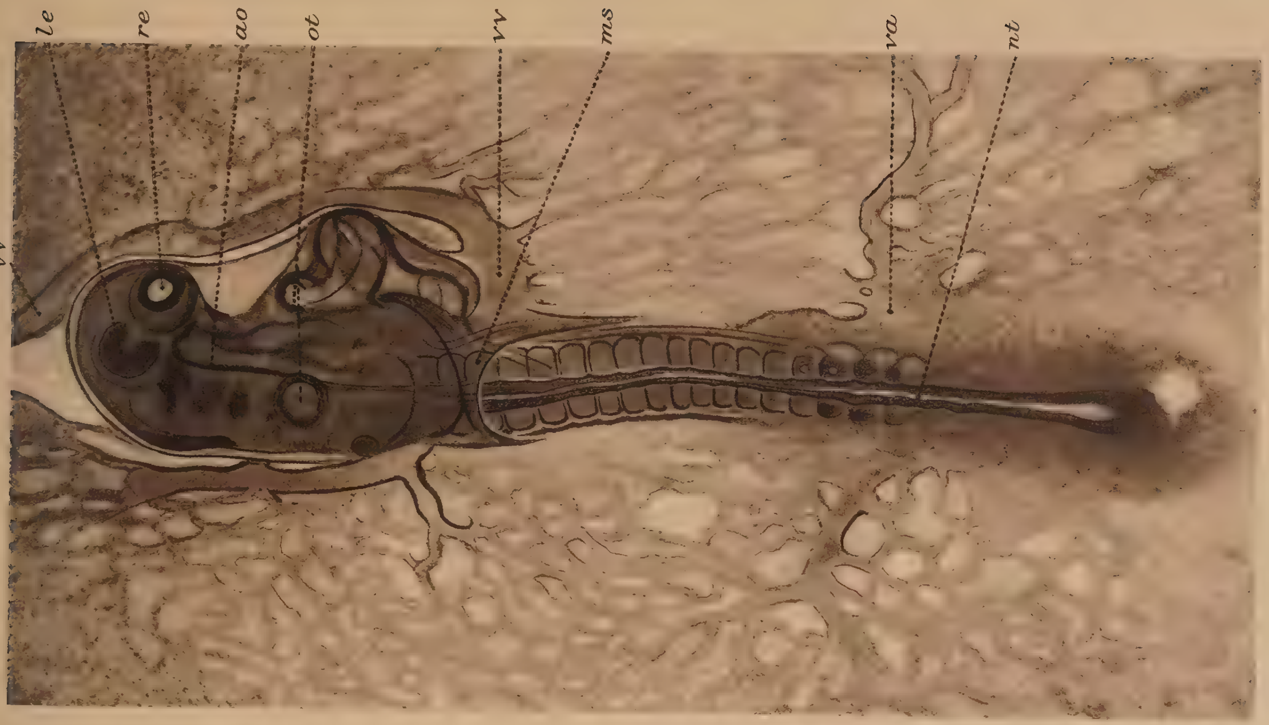
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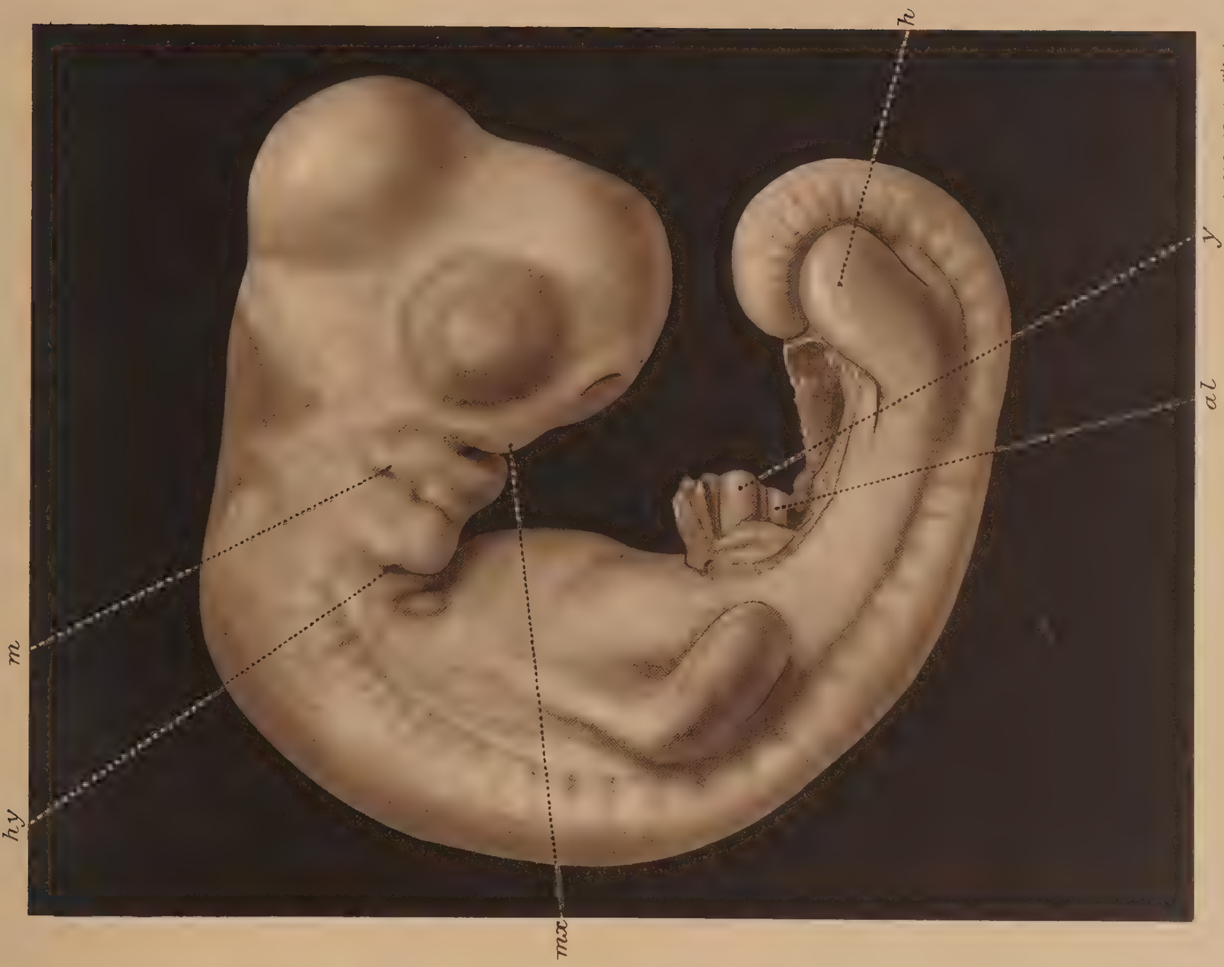
PENGUIN EMBRYOS.

PLATE II

Pygoscelis papua.

Fig. 1. Embryo, stage 18 (No. 3). *a*, sero-amniotic connective; *al*, allantois; *c*, visceral clefts; *f*, fore-limb rudiment; *h*, hind-limb rudiment; *p*, pericardiac wall; *v*, ventricle (of heart).

Fig. 2. Embryo, stage 25 (No. 4). *al*, allantois; *h*, hind-limb bud; *hy*, hyoid arch; *m*, mandibular ridge; *mx*, maxillary ridge; *y*, yolk stalk.



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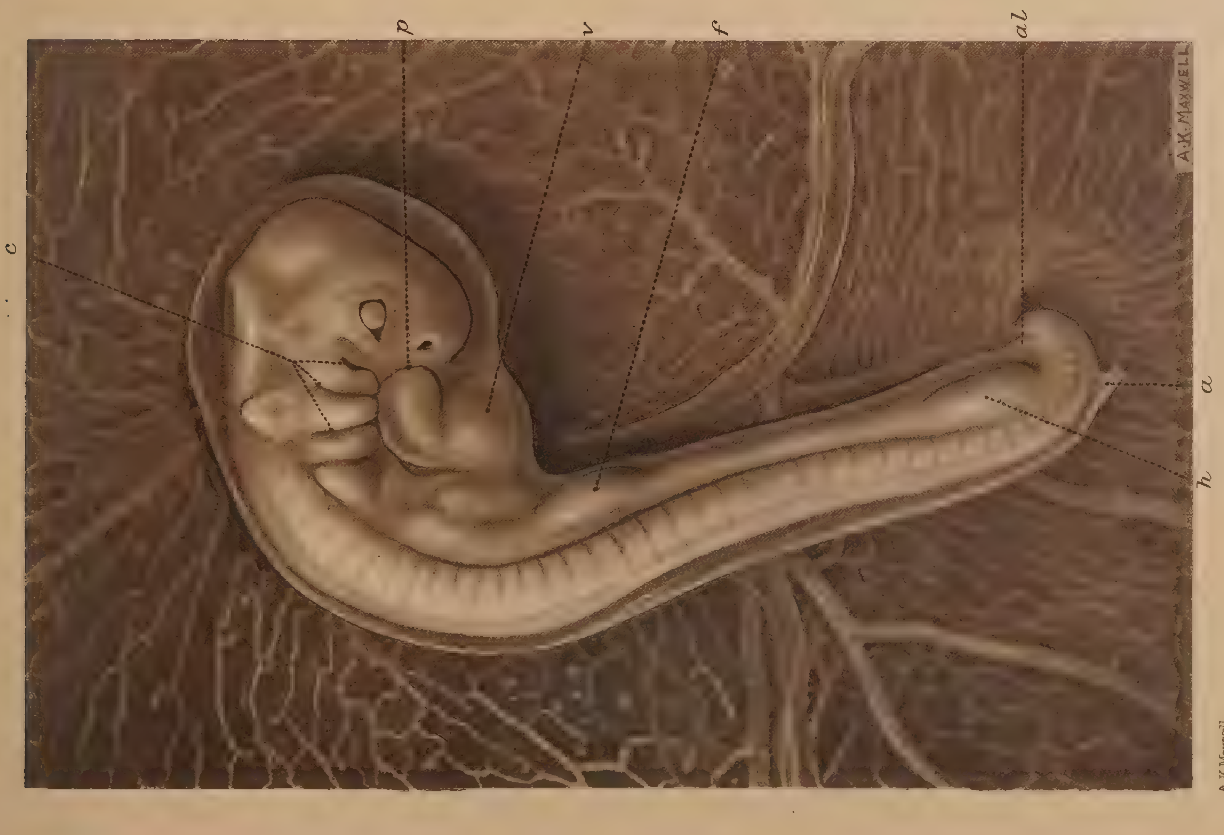
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PENGUIN EMBRYOS.

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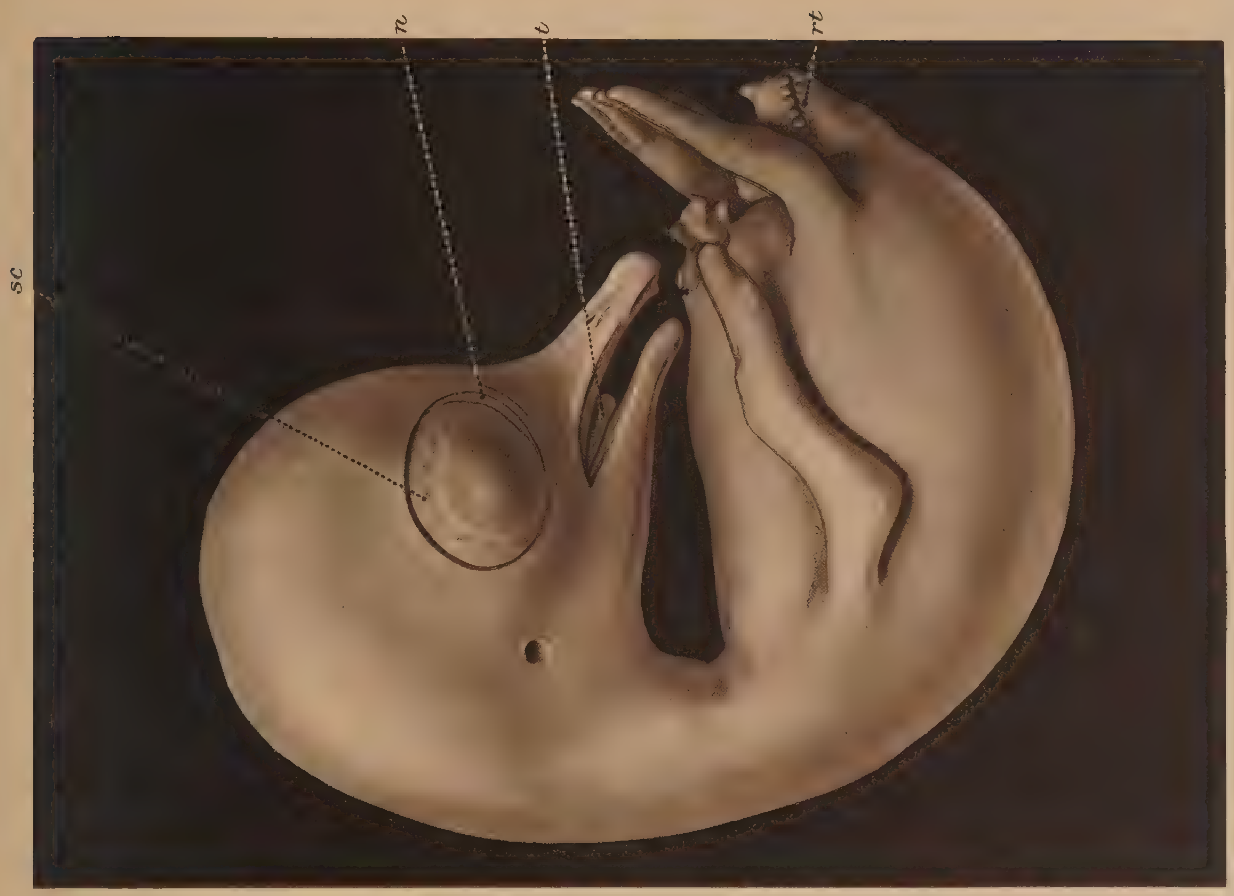
PLATE III

Pygoscelis papua.

Fig. 1. Embryo, stage 31 (No. 5). *b*, beak; *l*, limb buds; *op*, operculum.

Fig. 2. Embryo, stage 34 (No. 6). *n*, nictitating membrane; *rt*, feather papillae; *sc*, papillae sclerae; *t*, tongue.



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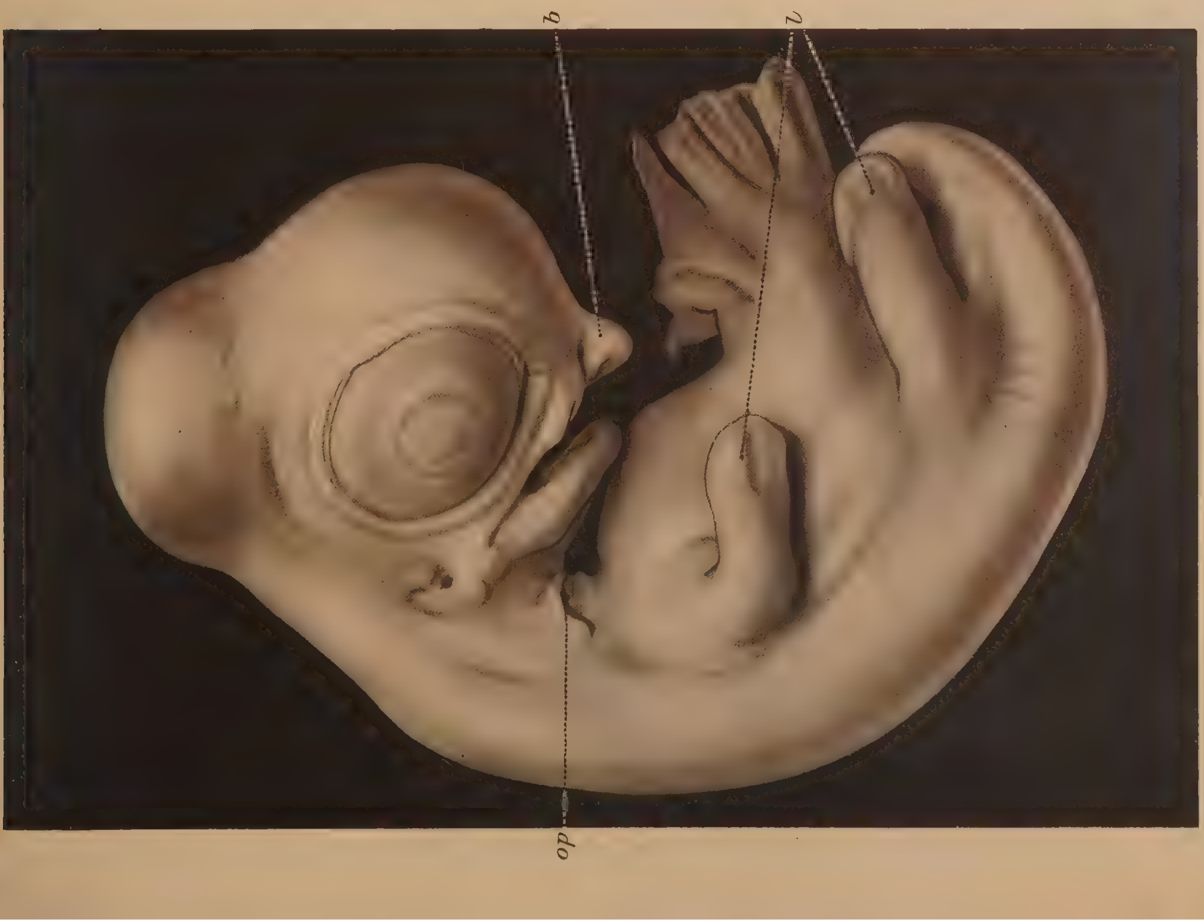

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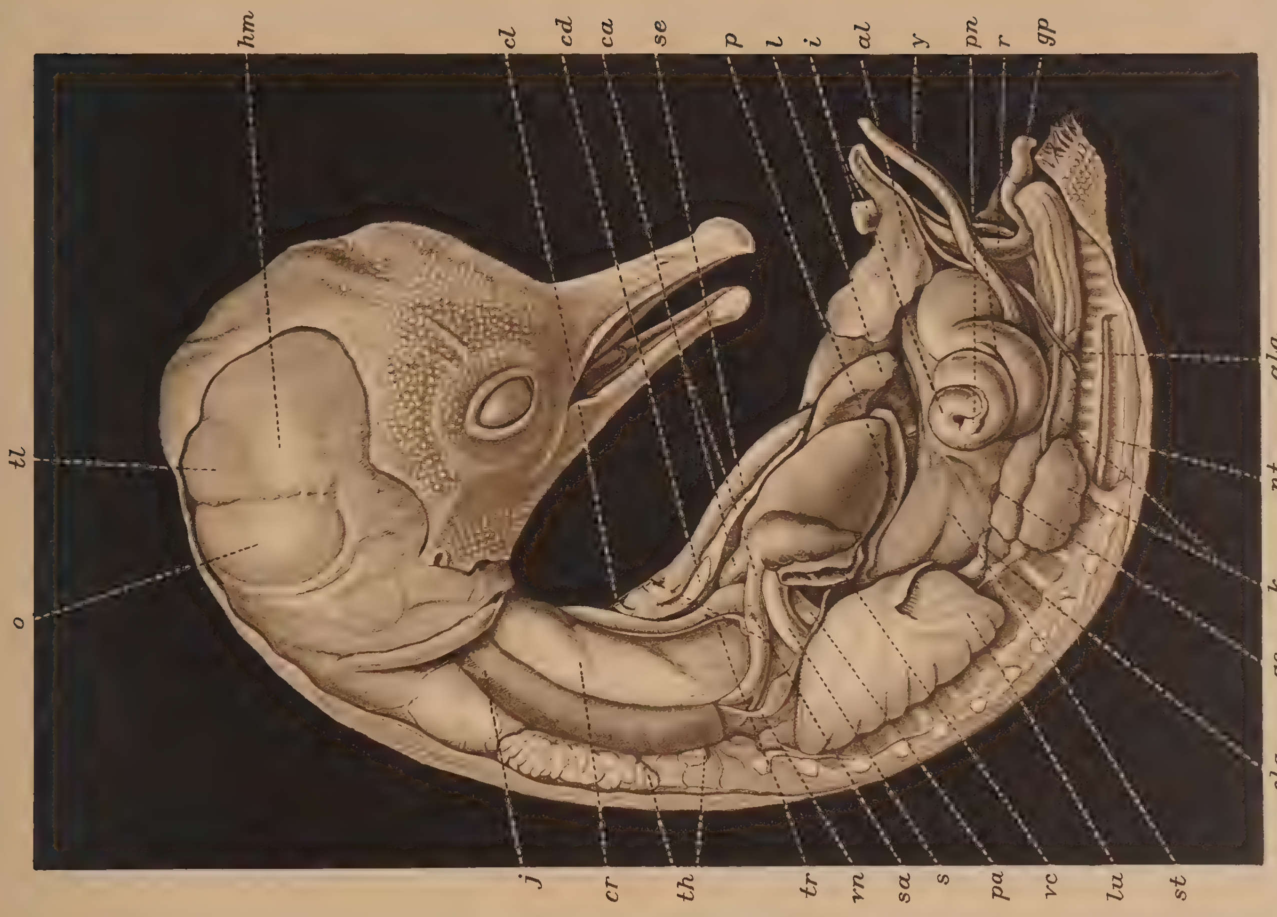
PLATE IV

Pygoscelis papua.

Fig. 1. Embryo, stage 37 (No. 7). *n*, nictitating membrane; *rm*, feather papillae of wing.

Fig. 2. Dissection right side (right lobe of liver and part of intestine removed). *al*, allantois; *ala*, right allantoic artery; *ca*, carotid artery; *cd*, coracoid; *cl*, clavicle; *cla*, coeliac artery; *cr*, crop region; *go*, gonad; *gp*, genital papilla; *hm*, hemispheres; *i*, intestine; *j*, jugular vein; *k*, opisthonephros; *l*, liver; *lu*, lung; *nt*, neural tube; *o*, optic lobe; *p*, pericardiac wall; *pa*, pulmonary artery; *pn*, pancreas; *r*, rectum; *s*, systemic aorta; *sa*, subclavian artery; *se*, sternum; *st*, stomach; *tl*, thalamencephalon; *th*, thymus gland; *tr*, trachea; *vc*, vena cava; *vn*, vagus nerve; *y*, yolk duct.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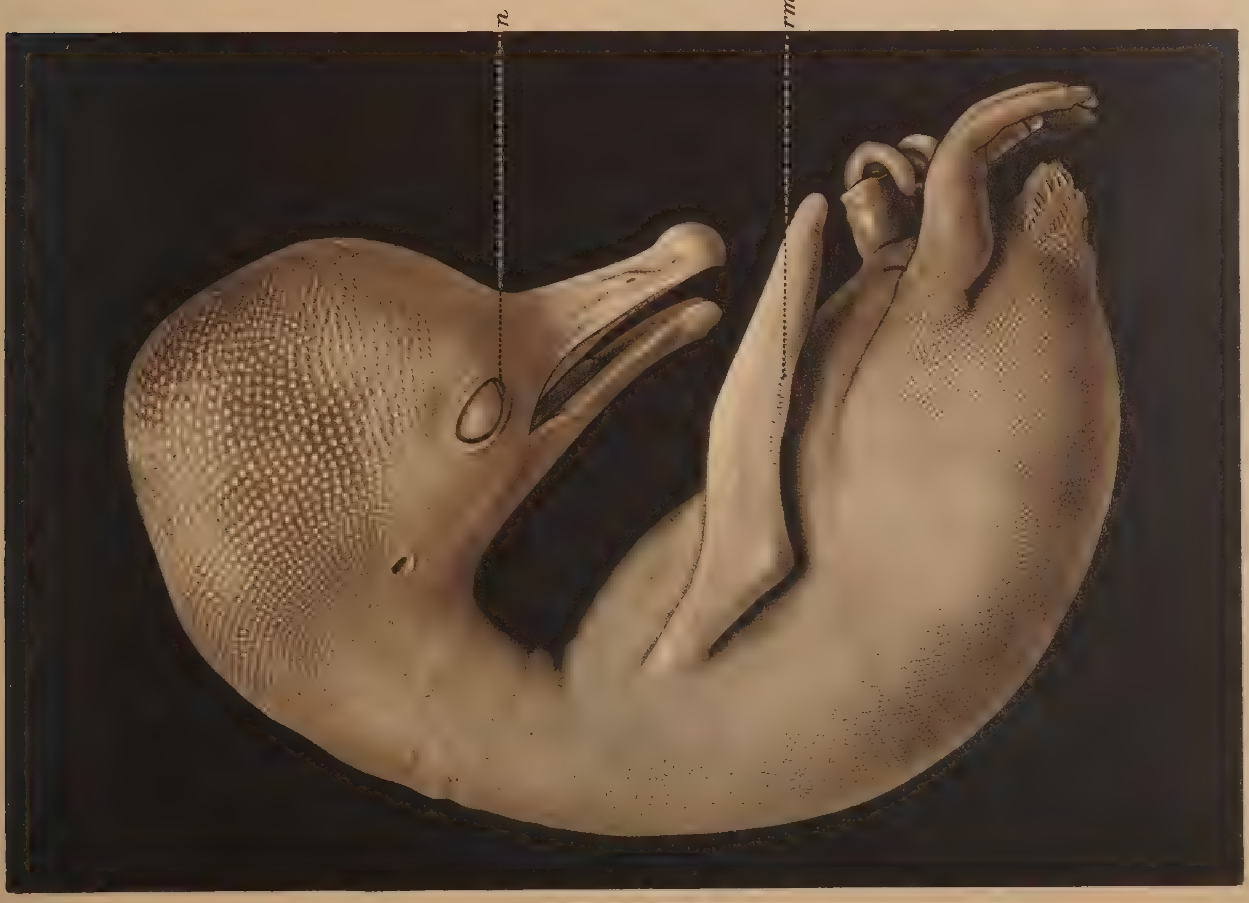

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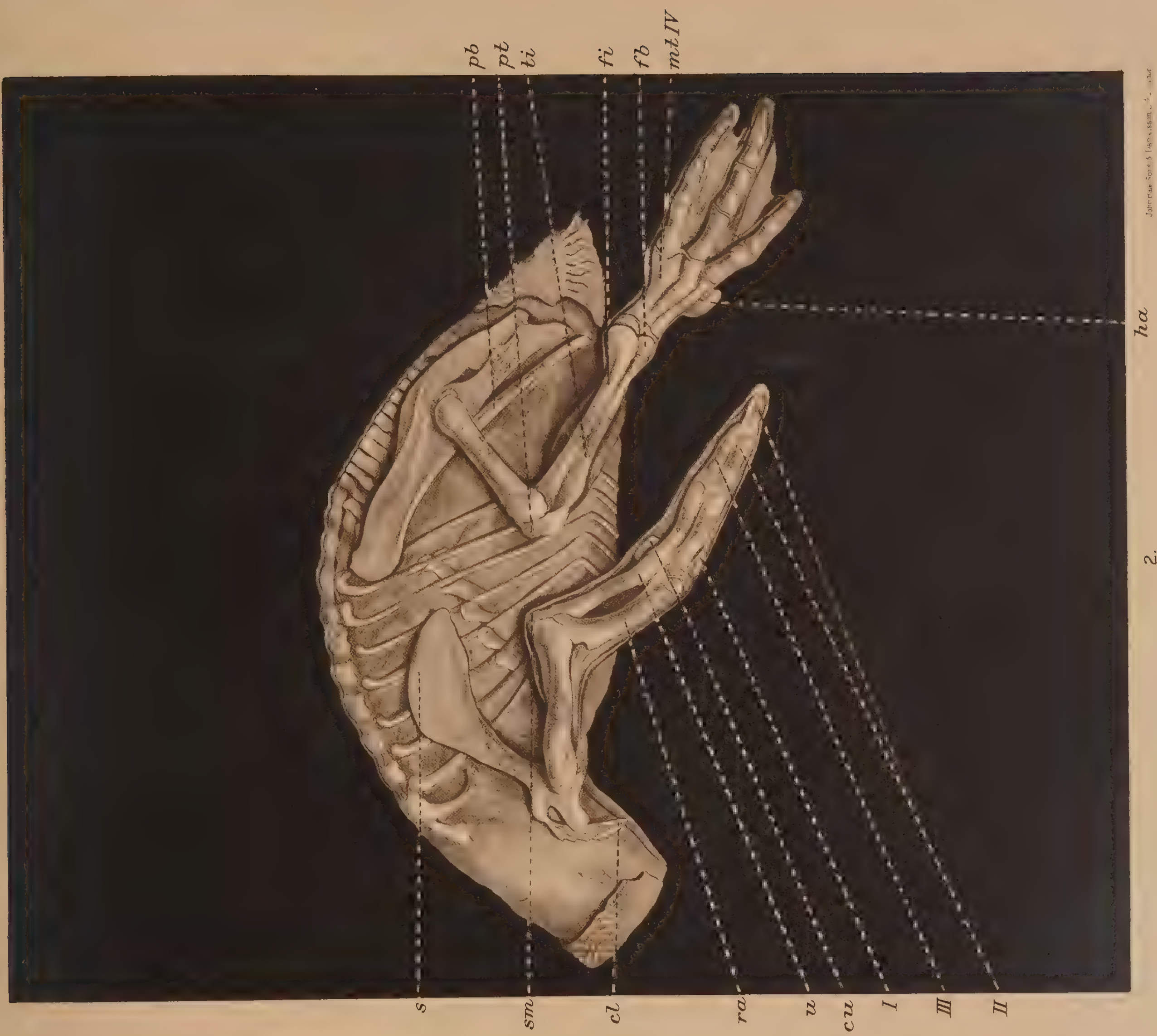
PENGUIN EMBRYOS.

PLATE V

Pygoscelis papua.

Fig. 1. Embryo, stage 37 (No. 7), deep ventral dissection. *ala*, allantoic artery; *bf*, bursa Fabricii; *br*, bronchus; *cla*, coeliac artery; *cr*, crop region; *crd*, thyroid rudiment; *da*, dorsal aorta; *db*, ductus Botalli; *go*, gonad; *gp*, genital papilla; *ina*, innominate artery; *k*, opisthonephros; *lu*, lung; *p*, pericardiac boundary; *pa*, pulmonary artery; *pv*, pulmonary vein; *rea*, renal artery; *x*, ureter; *y*, Wolffian duct; *z*, Müllerian duct; 1–5, orifices of air sacs.

Fig. 2. Skeletal elements, left side. *cl*, clavicle; *cu*, cuneiform; *fb*, fibulare; *fi*, fibula; *ha*, hallux; *pb*, pubis; *pt*, patella; *ra*, radius; *s*, scapula; *sm*, sesamoid; *ti*, tibia; *u*, ulna; *mt* IV, metatarsal IV; *I*, *II*, *III*, digits.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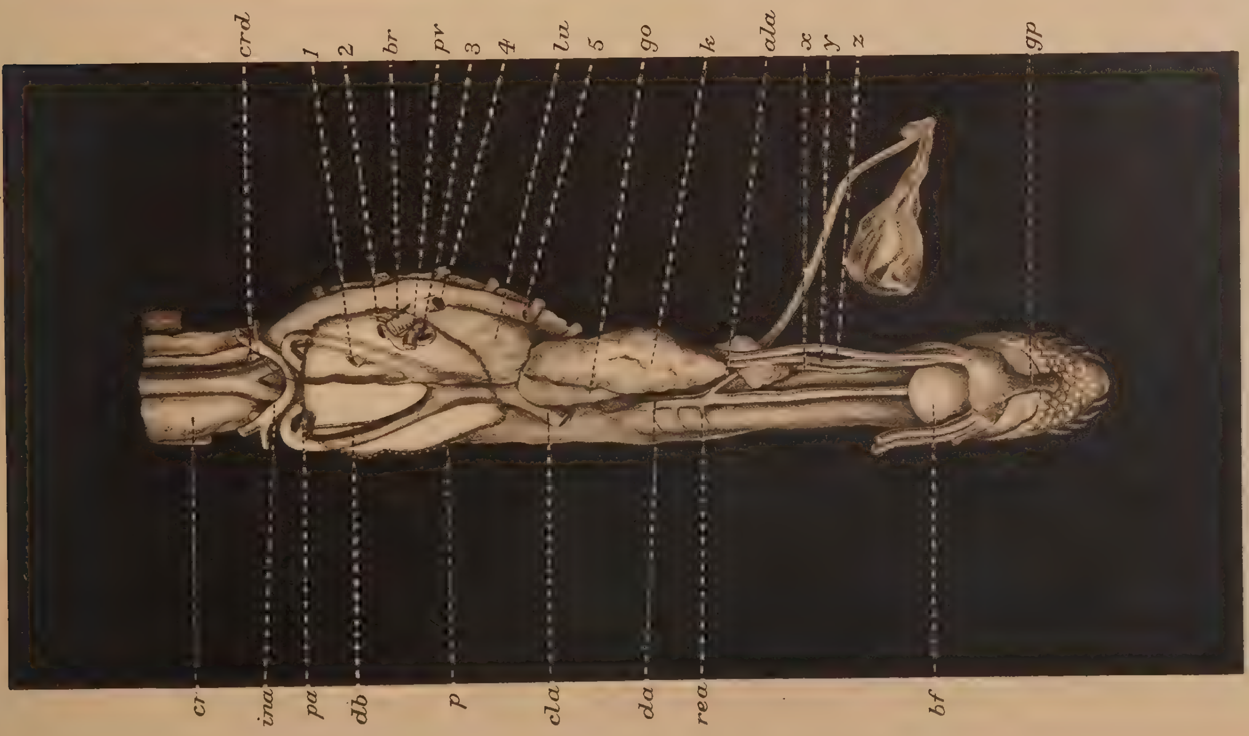
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PENGUIN EMBRYOS.

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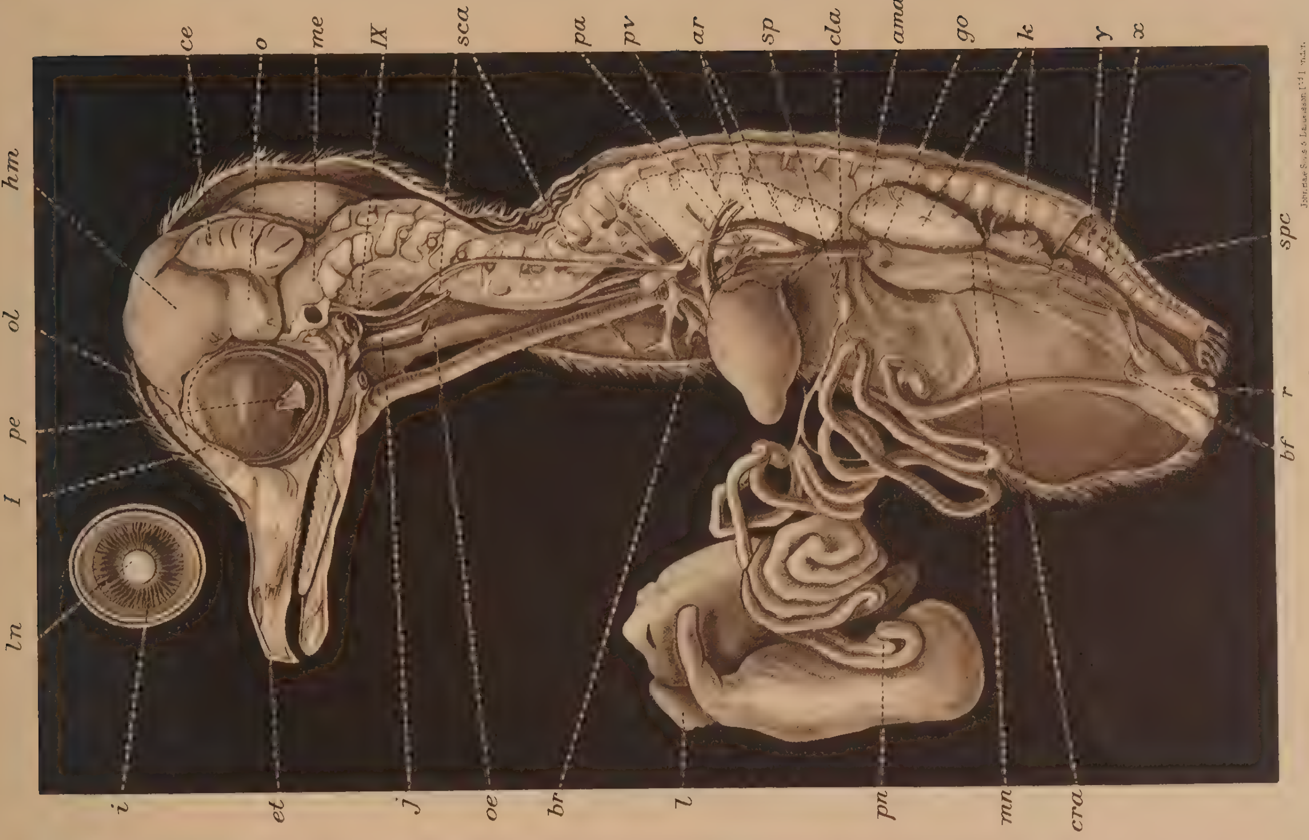
PLATE VI

Pygoscelis antarctica.

Fig. 1. Embryo No. 8, ventral dissection of body with head and neck turned to right. *ca*, carotid artery; *gb*, gall bladder; *l*, liver; *ne*, neonychium; *rl*, retractor linguae; *sa*, subclavian artery; *st*, stomach; *sv*, subclavian vein; *td*, thyroid gland; *uv*, umbilical vein; *vn*, vagus nerve; *ys*, yolk sac.

Fig. 2. Deep lateral dissection, left side. *ama*, anterior mesenteric artery; *ar*, aortic root; *bf*, bursa Fabricii; *br*, bronchus; *ce*, cerebellum; *cla*, coeliac artery; *cra*, crural artery; *et*, egg tooth; *go*, gonad; *hm*, hemisphere; *i*, iris; *j*, jugular vein; *k*, metanephros; *l*, liver; *ln*, lens; *me*, medulla oblongata; *mn*, genital duct; *o*, optic lobe; *oe*, oesophagus; *ol*, olfactory lobe; *pa*, pulmonary artery; *pe*, pecten; *pn*, pancreas; *pv*, pulmonary vein; *r*, rectum; *sca*, subcutaneous cervical artery; *sp*, spleen; *spc*, spinal cord; *x*, ureter; *y*, genital duct. *I* and *IX* cranial nerves.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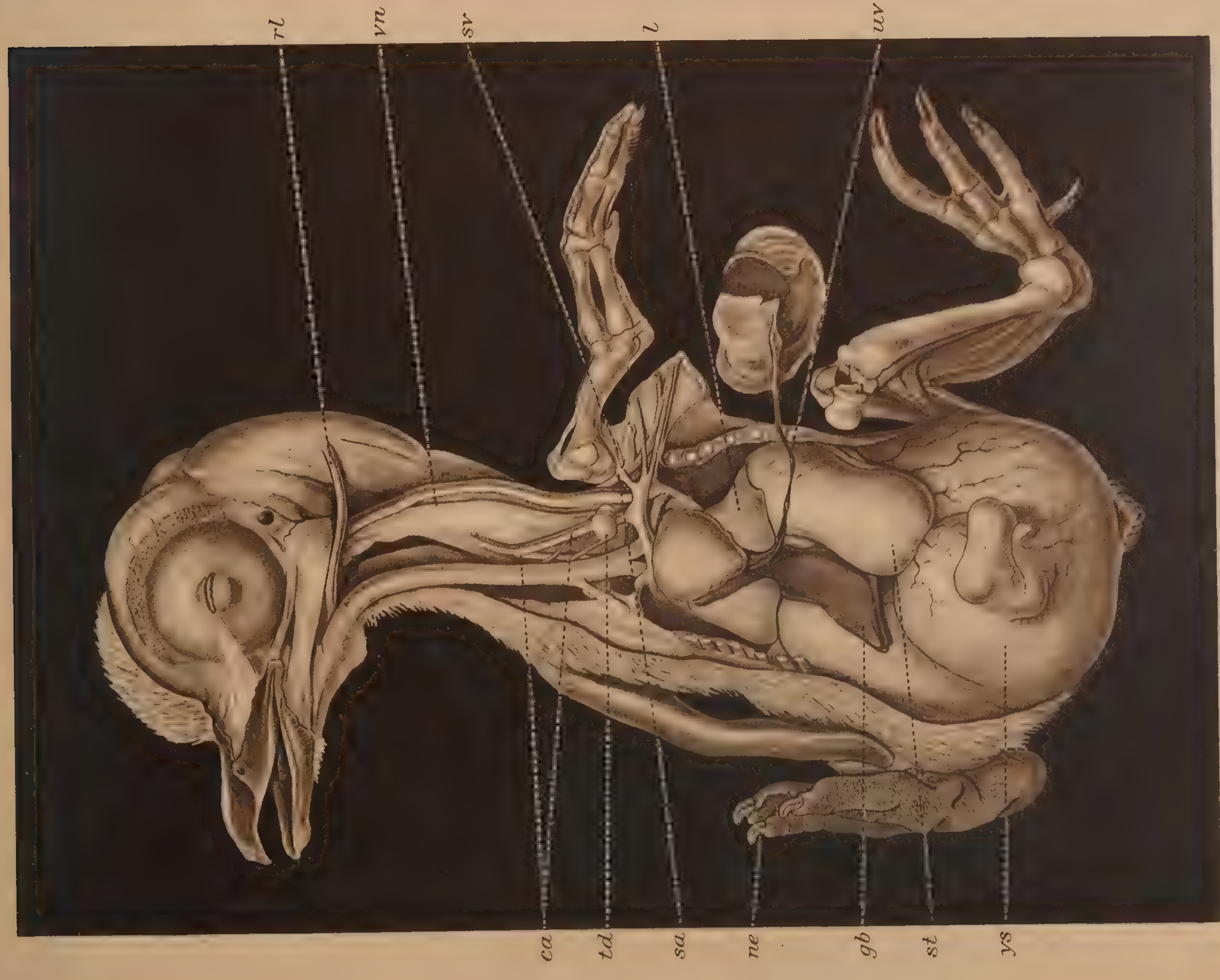
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PENGUIN EMBRYOS.

C. Brown Kelly

John Bale Sons & Danielsson Ltd. London

[*Discovery Reports. Vol. VI, pp.* 165–190, *Plates VII–XLII, December*, 1932.]

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ON THE DISTRIBUTION AND MOVEMENTS OF WHALES ON THE SOUTH GEORGIA AND SOUTH SHETLAND WHALING GROUNDS

By

STANLEY KEMP, Sc.D., F.R.S.

AND

A. G. BENNETT

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ON THE DISTRIBUTION AND MOVEMENTS OF WHALES ON THE SOUTH GEORGIA AND SOUTH SHETLAND WHALING GROUNDS

By Stanley Kemp, Sc.D., F.R.S., and A. G. Bennett

(Plates VII–XLII; text-figs. 1–6)

INTRODUCTION

In the year 1922 the Government of the Falkland Islands issued to the whaling companies operating under licence in the Dependencies a form designed to give information on the distribution and movements of whales in the whaling areas. The companies were asked to give the approximate position of each whale that was killed, and if whales were seen to be moving, they were asked to report the direction of movement. The vast majority of the completed forms[1] relate to Blue and Fin whales taken either off South Georgia or the South Shetlands, and it is with the data concerning these species from these two areas that the present paper is concerned.

The information obtained in this way presents a number of interesting features. It demonstrates the particular regions within the areas where whales are accustomed to concentrate, and it shows how these concentrations have shifted during the course of the season. It indicates with some clearness the seasonal variations which have occurred, and, in South Georgia, how greatly the whaling grounds have been extended in recent years. Evidence bearing on the movements of whales is available both from alterations from month to month in the centres of concentration and from the direct observations recorded by the gunners. The results from these two sources are not always in agreement and it would appear that reliable data can only be obtained by whale marking. The first series of marking experiments has unfortunately proved unsuccessful: but methods have been modified in accordance with experience and renewed attempts will be made in the season 1932–3.

In the present state of our knowledge it is difficult, if not impossible, to explain the seasonal variations which these data have brought to light; but as information accumulates on the plankton and hydrology of the areas some of the underlying causes may be discovered.

Few attempts have hitherto been made to ascertain the distribution of whales in whaling areas. Detailed records are usually not kept by the whaling companies and unless arrangements are made beforehand particulars cannot be obtained. Hjort, Lie and Ruud[1] have, however, published a valuable summary of the catches made in the Antarctic in 1929–30 and 1930–1 by Norwegian pelagic factories, illustrated by charts which cover an area extending from the South Shetland Islands to the Ross Sea. In the northern hemisphere D'Arcy Thompson in 1928[2] analysed data obtained at the Scottish whaling stations and published charts, based on records for seven seasons, which show for each month the positions where Fin and Sei whales were captured. In earlier papers, published in 1918,[3] the same author gave charts showing the positions off the Scottish coast where Nordcapers, Sperm whales and Blue whales had been taken.

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[1] The forms are stored in the offices of the Falkland Islands Government at Port Stanley.

COLLECTION AND ANALYSIS OF THE DATA

The forms, as already mentioned, give information of two kinds, namely the positions where whales were killed and observations on the directions in which whales were moving. The reliability of the records, their limitations and the methods employed in analysis may be conveniently discussed under these two heads.

POSITIONAL DATA

The positions recorded for each whale are invariably given by the whalers as bearing and distance from the land, and since the whale-catchers are often out for several days, frequently in thick weather and many miles from the coast, they can only be regarded as rather rough approximations. We think, however, that this does not seriously affect the accuracy of the charts on which the results are summarized, for errors from this source tend to be eliminated by the methods we have employed. It is, moreover, only the main concentrations of whales that show features of interest, and these, so far as they were discovered by the whalers, we believe to be correctly indicated.

As will be seen from Plates XXIII and XL the areas within which whales have been killed, during the seasons with which these results are concerned, are very large. Off the coasts of South Georgia the whaling grounds are some 300 miles both in length and breadth, embracing an area of over 50,000 square miles. At the South Shetlands the grounds extend from east and south of Clarence Island south-west to the Biscoe Archipelago: the length is some 570 miles, the breadth in the middle about 160 miles and the area over 80,000 square miles. It is, however, only on exceptional occasions—when whales are uncommonly scarce or, in the South Shetlands, at particular times of the year—that the more distant parts of the area are visited, and as will be seen from the monthly charts there is thus great variation in the extent of ground covered by the whalers. When whales are plentiful in inshore waters the catchers will naturally not go farther afield, and we have evidently no means of knowing how abundant whales may be in the unexplored parts. When, however, a large area is covered we may be confident that within its limits no considerable concentration of whales existed without being detected. In using the charts as evidence of distribution of whales this limitation must constantly be borne in mind.

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[1] Hjort, Lie and Ruud, *Norwegian Pelagic Whaling in the Antarctic.* Norsk Vidensk.-Akad. Oslo, Hvalradets Skrifter, No. 3, 1932.

[2] D'Arcy Thompson, *On Whales Landed at the Scottish Whaling Stations during the years* 1908–14 *and* 1920–7. Fisheries, Scotland, Sci. Invest., III, 1928.

[3] D'Arcy Thompson, *On Whales Landed at the Scottish Whaling Stations, especially during the years* 1908–14, Part I. Scottish Naturalist, 1918, p. 197. Parts II, III, *ibid.*, p. 223.

During the seasons with which we are dealing whaling in South Georgia was conducted from five land stations and, until 1929–30, from one permanently moored floating factory, all situated on the north-east coast of the island (Fig. 1). The whale-catchers were thus working from the same base throughout the season. At the South Shetlands conditions were different, for the land is heavily glaciated, and it is only at Deception Island, where the ice is melted by lingering traces of volcanic activity, that the erection of a shore station has been possible. In addition to this station there is a considerable number of floating factories, and these though often moored at Deception Island, were frequently shifted to other harbours. Those most often used were Admiralty Bay in King George Island, Melchior Harbour in Schollaert Channel and Port Lockroy in Neumayr Channel (Fig. 2). Other harbours in Trinity Island and in Gerlache Strait were occasionally used, and in some seasons, when ice conditions were exceptionally favourable, the factories went as far south as the Biscoe Archipelago. On approaching the whaling grounds in the spring the factories were often delayed by pack-ice, and not infrequently they worked for a period along the ice edge in the neighbourhood while awaiting the opportunity to enter Bransfield Strait. Since the whale-catchers do not ordinarily go more than 100 miles from the parent ship, it is evident that the position of

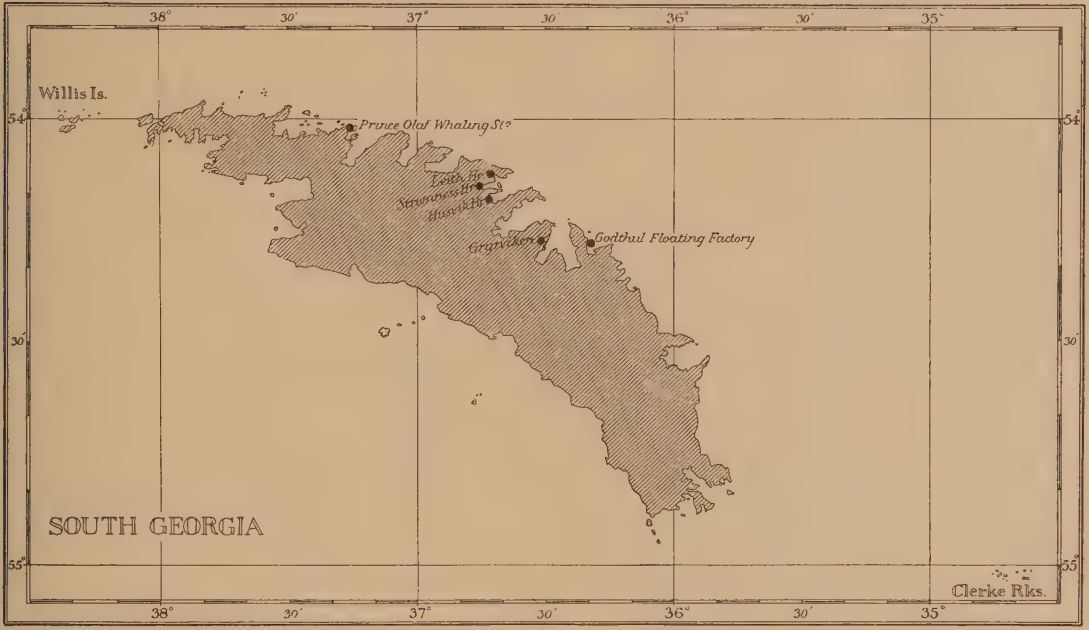
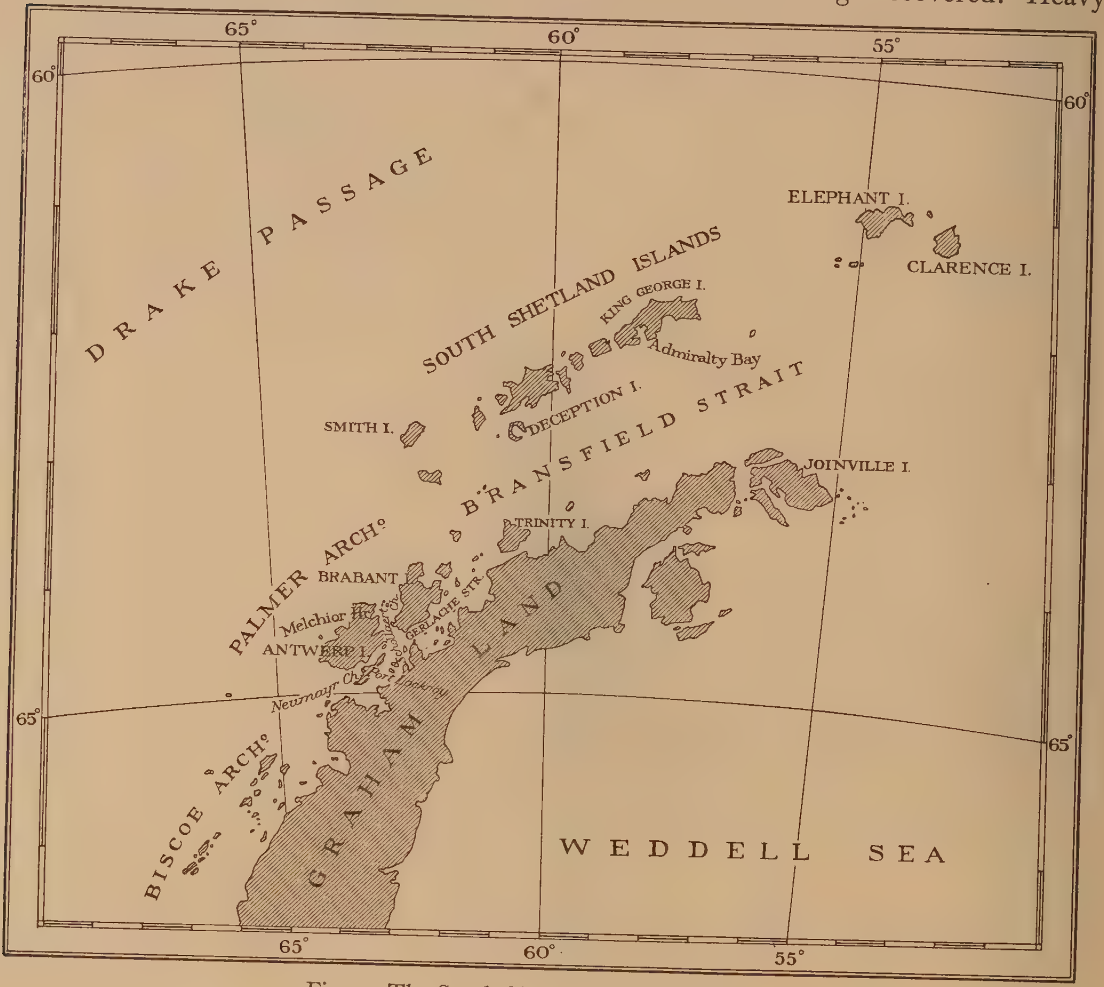


Fig. 1. South Georgia, showing positions of whaling stations.

the latter will be reflected in our charts of positions. During most of the period under review there were, however, enough factories employed to cover the whole ground adequately; and since their movements were determined by the positions in which whales were most abundant, we think the limitations to the data are much the same as those on the South Georgia grounds—we believe that within the area examined no large concentration of whales could have existed without being discovered. Heavy pack-ice will naturally limit the movement of the factories, but it will equally limit the movements of the whales; for while whales—Blue whales in particular—often concentrate along its margin, they will not penetrate it unless sufficiently open to permit the passage of a vessel.[1]


65°
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DRAKE PASSAGE
SOUTH SHETLAND ISLANDS
ELEPHANT I.
CLARENCE I.
KING GEORGE I.
Admiralty Bay
DECEPTION I.
SMITH I.
BRANSFIELD STRAIT
JOINVILLE I.
TRINITY I.
PALMER ARCH^O
BRABANT I.
Melchior Hr.
Schollaert Ch.
GERLACHE STR.
ANTWERP I.
Neumayr Ch.
Port Lockroy
GRAHAM LAND
65°
65°
BISCOE ARCH^O
WEDDELL SEA
65°
60°
55°

Fig. 2. The South Shetland whaling area.

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[1] Captain Jørgen Øre, a veteran among South Shetland whalers, has told us that at the beginning of season 1914–15 he met impenetrable pack-ice, of extreme thickness and with many included icebergs, far to the north of the islands. He sent his catchers long distances afield to look for an opening; but they could find none, and for some time he worked along the ice-edge, taking Blue whales in good numbers. Then one day the whales vanished: he realized at once that a passage to the south must have opened, and next day he found a way through to Bransfield Strait.

Difficulties have been met with in interpreting some of the forms. Sometimes they have not been filled in with sufficient care, and sometimes, especially in those from the South Shetlands, the gunners have used place-names of their own which are not to be found on any chart. For one reason or another we have had to reject numerous forms as unintelligible, with the result that the number of positions recorded for any season is much below the total number of whales actually killed.

In working up the data the positions were in the first place plotted, with due allowance for magnetic variation, on large-scale charts, separate sheets being used for Fin and Blue whales and for each month of the season. These charts were then divided up into squares of convenient size and the number of whales killed in each square was counted. For the South Georgia grounds the area of each square was a quarter degree of latitude and half a degree of longitude (15 × 17·4 miles = 261 sq. miles). In the South Shetland area, which is much larger, each square was half a degree of latitude and a whole degree of longitude (30 × 27·6 miles = 828 sq. miles). Contours have been drawn[1] on the assumption that the number of whales in any one square was concentrated at its centre, and it is these charts which are here reproduced on a greatly reduced scale.[2] By this method it is easy to prepare charts which will represent the total monthly captures throughout the series of seasons, or, indeed, to summarize the whole of the records for one species on a single chart. Such combined charts may show interesting features, but the variation from one season to another is sometimes so great at South Georgia that monthly totals cannot be employed to advantage.

Owing to an error in the original instructions Blue whales were not distinguished from Fin whales in the South Georgia returns for the first half of season 1922–3. The records for this season have therefore been omitted, the data covering eight seasons, from 1923–4 to 1930–1 inclusive. For this period we have been able to chart 29,266 positions, and of these 16,005 relate to Fin whales and 13,261 to Blue whales. The numbers for each month are shown in Tables I and II, with the totals for each season and the total number taken in each season by the combined South Georgia companies.

Data are available from the South Shetlands since 1922–3, but in recent years the returns are not satisfactory owing to the new methods which the whalers have adopted. Prior to 1927–8 the factories were moored throughout the season in one or other of the harbours situated in the South Shetlands and Palmer Archipelago. If the fleet encountered heavy pack-ice when approaching the islands in the spring, it often worked for a short time along the ice-edge in the neighbourhood, moving into Bransfield Strait, and to Admiralty Bay or Deception Island, as soon as the ice permitted. In 1927–8, however, more ambitious pelagic operations began, and on an increasingly large scale.

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[1] Charts for individual seasons are contoured by tens up to fifty; those for monthly totals over the whole series of seasons by twenties up to one hundred; those for grand totals by hundreds up to five hundred.

[2] Recent surveys, made during the course of the Discovery Investigations, have led to considerable revision of the coast line of South Georgia and the South Shetlands, and the alterations are incorporated in the latest Admiralty charts. The work of plotting the data presented in this paper began before these surveys were completed; the earlier charts have thus been used and we have thought it best to reproduce these in their original form, without the recent modifications.

TABLE I

Numbers of Fin whales on the South Georgia grounds with recorded positions of capture

	1923–4	1924–5	1925–6	1926–7	1927–8	1928–9	1929–30	1930–1
September	—	24	—	—	—	43	88	—
October	38	162	122	56	123	509	219	166
November	88	190	144	158	238	202	349	289
December	134	190	485	106	287	231	566	222
January	154	378	1196	202	279	766	770	231
February	116	305	1188	157	219	541	209	148
March	101	179	683	234	89	332	184	22
April	71	184	850	108	—	98	35	—
May	—	71	476	—	—	—	—	—
Total	702	1683	5144	1021	1235	2722	2420	1078
Total taken by South Georgia Stations	1375	2017	5713	1147	1357	3124	3404	1416

TABLE II

Numbers of Blue whales on the South Georgia grounds with recorded positions of capture

	1923–4	1924–5	1925–6	1926–7	1927–8	1928–9	1929–30	1930–1
September	—	17	31	—	—	—	—	—
October	52	197	139	260	312	52	31	188
November	143	590	75	515	662	219	97	237
December	356	730	89	813	556	282	59	236
January	205	420	188	841	272	413	93	117
February	176	377	406	492	68	60	—	50
March	39	373	397	344	17	82	32	—
April	48	309	230	48	—	15	—	—
May	—	137	74	—	—	—	—	—
Total	1019	3150	1629	3313	1887	1123	312	828
Total taken by South Georgia Stations	1926	3514	1845	3670	2125	1564	492	1084

In that year most of the factories spent the early months of the season along the ice-edge near the South Orkney and the South Sandwich Islands, returning later to Bransfield Strait, and in the two following seasons they spent still more time on the Weddell Sea ice-edge and only returned to Bransfield Strait at the end of February. These movements of the factories are reflected in the returns of positions. Since 1927–8 a very considerable part of the catch has been made to the east, far outside the area with which this report is concerned, and though the land station at Deception remained working throughout the period, returns from the Shetland area for the first half of the season have greatly diminished. So few records of Blue whales for 1929–30 and of both species for 1930–1 are available that they are insufficient for analysis.

The figures for the South Shetland area are thus for eight seasons of Fin whales, 1922–3 to 1929–30, and for seven seasons of Blue whales, 1922–3 to 1928–9[1]. The total number of positions recorded is 18,571, of which 11,849 relate to Fin whales and 6722 to Blue whales. The figures are shown in Tables III and IV, together with

Table III

Numbers of Fin whales on the South Shetland grounds with recorded positions of capture

	1922–3	1923–4	1924–5	1925–6	1926–7	1927–8	1928–9	1929–30
November	—	—	—	—	20			
December	61	126	181	320	260	22	27	51
January	232	298	496	593	342	106	29	85
February	237	460	227	332	396	196	250	355
March	378	213	365	500	556	428	481	571
April	164	127	314	172	677	469	444	288
Total	1072	1224	1583	1917	2251	1221	1231	1350
Total taken by South Shetland factories	1985	1559	1948	2390	3442			

Table IV

Numbers of Blue whales on the South Shetland grounds with recorded positions of capture

	1922–3	1923–4	1924–5	1925–6	1926–7	1927–8	1928–9
October	—	—	20				
November	82	161	181	243	114	113	
December	342	495	229	588	121	189	53
January	340	325	343	318	67	62	62
February	112	91	260	85	72	46	45
March	108	34	133	95	152	83	92
April	57	—	142	490	36	31	95
May	—	—	—	—	—	—	15
Total	1041	1106	1308	1819	562	524	362
Total taken by South Shetland factories	1993	1369	1642	2157	1275		

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[1] The Blue whale data for 1929–30 have, however, been incorporated in Plate XL.

the total numbers taken by the whaling vessels in the South Shetland area. The official returns, on which the latter are based, give only the grand totals taken by the South Shetland fleet. The areas in which the whales were taken are not discriminated, and it is thus not possible to include in these tables the total numbers taken in South Shetland waters for seasons 1927–8 and onwards.

DIRECTIONAL DATA

In addition to recording the positions in which whales were killed, gunners of the whale-catchers were asked to supply information on the directions in which Blue and Fin whales were seen to be travelling, and on this subject an even larger quantity of data has been collected than of that dealing with positions.

The value of the evidence obtained in this way is not easily estimated. A trained gunner can without question distinguish Blue and Fin whales accurately at a distance of several miles; but to determine the direction of movement, at least to an untrained observer, may be a matter of considerable difficulty. Blue and Fin whales normally blow three or four times in succession, and at each blow are visible at the surface for only a few seconds: they then sound and remain below water for some 10 or 15 minutes. If, as often happens, several whales are in company, they will generally rise to the surface and blow simultaneously. When whales are not plentiful it is possible to be reasonably certain that the same school is being kept under observation; but when they are abundant—and they are sometimes very abundant on Antarctic whaling grounds—the difficulties are greatly increased, so much so that one feels that even gunners with lifelong experience may be at fault. On the other hand the whale-catchers can only visit a comparatively small area in the few days they are away from the whaling station or factory ship; they will presumably become acquainted with the general trend of whale movement in the area, and if this has been correctly stated in their returns the observations should have some value.

As might be expected whales are not always travelling. On reaching a locality where food is plentiful they will merely cruise in the neighbourhood, and it is to be imagined that after a full meal they will show little activity. Large numbers of whales have been entered by the gunners as not moving; but the numbers shown as moving are usually in excess and sometimes greatly in excess.

These data on whale movement are of different quality to those which record positions in which whales were killed, for the latter, though they may be rather rough approximations, are ascertained facts, while the former might be regarded merely as an expression of the gunners' opinions. If, however, it were impossible to ascertain direction of movement and the data supplied are mere guess-work, analysis of the returns should demonstrate that the observations are unreliable. As explained below, resultant directions for each month have been worked out, and since these show some measure of consistency they are included in this report. The results, none the less, show wide variation and some of them present very great difficulty in interpretation. It is not improbable that many of the reported movements are merely those of whales cruising slowly about the whaling grounds and are thus of little significance.

In recording direction of movement the whalers used the eight cardinal and sub-cardinal points of the compass, noting the numbers seen travelling in each direction. As will be understood the numbers recorded are much higher than for positions: many more whales are sighted than are killed, and movements of the same whales are doubtless recorded on several occasions. With these records, as with those for positions, a number of forms have had to be rejected as inadequate or unintelligible.

In analysing the data the total numbers for each direction and for each month of the season were found. The directions for each month were then reduced from eight to four by subtraction of those travelling in opposite directions, and thence from four to two by finding the components along two lines at right angles to one another. A resultant direction and number was then obtained by means of traverse tables. We are indebted to Sub-Lieut. R. A. B. Ardley, R.N.R., and Lt.-Cmdr. J. M. Chaplin, R.N., for their valuable assistance in obtaining these resultant values. The resultant directions are shown in Figs. 3–6 (pp. 182–3, 188–9) by means of arrows, and the length of each arrow represents the resultant number of whales travelling in this direction expressed as the percentage of the total number recorded as moving. Records with long arrows thus have greater validity than those with short arrows. Results for any one month are evidently of little value if only a small number of whales was sighted, and if the numbers travelling opposite ways are so evenly balanced that only a small percentage is found moving in the resultant direction the record will also be unimportant. We have omitted all monthly records in which the recorded number of moving whales falls below 50, and we have also omitted those in which the resultant number is less than 10 per cent. of the total number moving.

The numbers of whales for which directions were recorded are shown in Tables V–VIII. The data from South Georgia cover eight seasons, 1923–4 to 1930–1, and comprise observations on 55,210 Fin whales and 17,706 Blue whales. Those for the South Shetlands, for 53,573 Fin whales and 10,761 Blue whales, were obtained during

Table V

Numbers of Fin whales on the South Georgia grounds with recorded direction of movement

	1923–4	1924–5	1925–6	1926–7	1927–8	1928–9	1929–30	1930–1
September	—	64	—	—	—	109	428	—
October	147	616	267	141	373	1907	950	537
November	246	1138	325	527	946	769	1340	1133
December	305	519	1411	393	1272	897	2156	857
January	465	1105	3862	957	956	3586	3170	1037
February	472	865	4015	621	605	1823	(719)	719
March	416	505	1644	(866)	293	1204	561	80
April	230	449	1898	414	—	350	93	—
May	—	208	1249	—	—	—	—	—
Total	2281	5469	14671	3919	4445	10645	9417	4363

TABLE VI

Numbers of Blue whales on the South Georgia grounds with recorded direction of movement

	1923–4	1924–5	1925–6	1926–7	1927–8	1928–9	1929–30	1930–1
October	78	319	(130)	413	473	63	62	272
November	124	712	74	745	794	393	148	352
December	407	862	88	1380	638	505	86	431
January	267	525	182	1383	325	624	158	212
February	(170)	382	370	834	71	102	—	73
March	57	458	539	432	—	119	—	—
April	85	321	207	—	—	—	—	—
May	—	171	90	—	—	—	—	—
Total	1188	3750	1680	5187	2301	1806	454	1340

TABLE VII

Numbers of Fin whales on the South Shetland grounds with recorded direction of movement

	1922–3	1923–4	1924–5	1925–6	1926–7	1927–8	1928–9	1929–30	1930–1
November	—	—	116	—	—	—	—	—	—
December	151	490	884	1373	844	118	144	210	237
January	559	1793	2840	3756	1012	461	113	536	(252)
February	1088	2863	1140	1440	1541	1070	1309	1685	540
March	1037	932	1694	2111	2330	1754	2403	3110	562
April	(334)	417	1346	456	(1929)	1592	1734	1194	73
Total	3169	6495	8020	9136	7656	4995	5703	6735	1664

TABLE VIII

Numbers of Blue whales on the South Shetland grounds with recorded direction of movement

	1922–3	1923–4	1924–5	1925–6	1926–7	1927–8	1928–9	1929–30	1930–1
November	99	198	408	330	(143)	181	—	—	54
December	324	713	449	944	178	307	126	95	124
January	457	425	609	560	62	118	122	107	64
February	189	113	488	(92)	(54)	—	78	74	(75)
March	155	—	211	(118)	167	144	153	—	111
April	118	—	231	675	—	50	194	—	—
May	—	—	—	—	—	—	74	—	—
Total	1342	1449	2396	2719	604	800	747	276	428

the nine seasons 1922–3 to 1930–1. In these tables numbers which have yielded a resultant value of less than 10 per cent and are thus not represented graphically in Figs. 3–6 are enclosed in brackets.

DISCUSSION OF RESULTS

SOUTH GEORGIA WHALING GROUNDS

The whaling grounds at South Georgia are visited annually during the southern summer by both Blue and Fin whales. Seasons vary greatly: in some years Fin whales will be taken much more abundantly than Blue, in some years *vice versa*; in some years both species are plentiful and in some both are scarce. These marked fluctuations are no doubt mainly dependent on alterations in the environment, and it appears probable that the predominance of one species over another is determined, at least in some measure, by the position of the ice-edge and the temperature of the water. Interesting evidence bearing on this point has recently been published by Sir Sidney Harmer.[1]

Both species, however, have the same objective in visiting the island. They do so in order to make use of the abundant food supplies that are to be found there. And since the food of Blue and Fin whales is the same, and its presence appears to be largely determined by a system of currents which varies but little, it is to be expected that no differences will be found in the distribution of the two species on the whaling grounds. That this is true is shown by Plate XXIII, in which all recorded positions of capture over a series of eight years are incorporated. It will be seen from the charts that the two species are taken over similar areas and that there is a remarkably close agreement in the contours illustrating regions of concentration.

That the principal whaling grounds lie to the north-east of South Georgia is to be explained on hydrological grounds. It is due to the system of currents which prevails in the neighbourhood of the island. One of the currents, which comes from the Pacific, flows through Drake Passage to the south of Cape Horn, and taking a north-easterly direction passes to the west of South Georgia. As it progresses northwards it comes more and more within the influence of the westerly winds and thus tends to take a more easterly course. The second and more important current is of Weddell Sea origin. It passes round the south-eastern end of South Georgia and then sweeps in a north-westerly direction along the coast. Before, however, it reaches the northern end of the land it meets the first current and the prevailing westerly winds and is reflected backwards to take a north-easterly course. The direction of the Weddell current is thus largely due to the presence of South Georgia and to the position which the island occupies athwart the region where the two streams converge.

Euphausia superba, the exclusive food of Blue and Fin whales in the Antarctic, is a pelagic prawn which drifts northwards to South Georgia from higher latitudes, the greater part coming from the Weddell area. The whaling grounds lie in the lee of South Georgia, and it is here, in the shelter of the island, that the Euphausians are able to congregate.

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[1] Harmer, *Southern Whaling*, Proc. Linn. Soc. London, 1931, p. 131.

Turning now to the records for individual seasons, illustrated for Fin whales in Plates VII to XIV and for Blue whales in Plates XV to XXII, it will be seen at once that there is great variation in the positions of the centres of concentration. Some part of this variation is no doubt to be attributed to irregularities in the arrival of different schools of whales. It has been ascertained at the Marine Biological Station[1] that there is no steady flow of whales on to the whaling grounds during the course of the season; on the contrary, the whales tend to arrive in batches, usually rather closely aggregated, of one species, and often with one or other sex or with immature predominating. As some schools arrive others may be leaving, and it is probable that certain schools remain longer on the grounds than others.

But when allowance has been made for these considerations, there still remain certain obvious differences in the distribution of whales in the seasons under review, and it appears that the most significant difference is to be found in the latter half of the season. In some years, in January and February, there is a very definite movement to the south-western side of the island, while in other years no trace of this movement is to be seen. In seasons 1924–5 and 1925–6 (Plates VIII, IX, XVI, XVII) there is no trace of this southward movement in either species, both of which show in the later months a remarkably heavy concentration close inshore to the north-east of the island. In 1923–4 and 1927–8 (Plates VII, XI, XV, XIX) both species show a movement towards the south-west. In 1926–7, when Blue whales preponderated, the concentrations of this species (Plate XVIII) shift round the ends of the island in the later months, but the movement is less marked in Fin whales (Plate X). In 1928–9 the abundance of the two species was reversed: Fin whales, which were very numerous, moved to the south (Plate XII), while this movement is not clearly shown by the smaller numbers of Blue whales (Plate XX). The data for seasons 1929–30 and 1930–1 do not give conclusive results: whales were scarcer and the area covered by the catchers had greatly increased; but except for Blue whales in 1929–30 there are indications that both species tended to move to the south in February and March.

Summarizing the observations it will be seen that when either species occurs in abundance it has moved to the south-western side of the island in the latter half of the season, and that the only exceptions to this statement are the two outstanding seasons 1924–5 and 1925–6. The dense inshore concentrations in these two seasons are perhaps to be explained in terms of hydrology and plankton; but unfortunately the research ships began their work at the end of the 1925–6 season and full surveys of the conditions on the South Georgia whaling grounds only date from 1926–7.

Sir Sidney Harmer, in his valuable account of "Southern Whaling",[2] has shown that there is a definite correlation between the mean temperature of the air at South Georgia in September and the order in which Blue and Fin whales reach their maxima in the following season. With low temperatures the Blue whale reaches its maximum first and with high temperatures the Fin. Working on these data he has been able to classify the seasons into three groups, but this grouping does not agree with that based on whale movements. The two exceptional seasons as regards movement do not appear in the same groups; 1924–5, with low September temperature, falls in Group I, and 1925 with high September temperature in Group III. This lack of agreement is perhaps to have been anticipated, for the relation which Sir Sidney Harmer has discovered is between events which occur in the early part of the season and it may well be that whale movements in the latter part are due to other causes.

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[1] Mackintosh and Wheeler, *Southern Blue and Fin Whales*, Discovery Reports, I, pp. 458–60 (1929).

[2] *Loc. cit.*, p. 131.

Another feature of interest in the South Georgia returns is the evidence of the great extension of the whaling grounds in recent years. Since whaling began in 1904 the whaling companies have made constant improvements in their whale-catchers, and with increased size and horse-power and greater speed they have been able to work farther afield.

If the South Georgia data for the eight seasons are divided into two four-year periods they yield the results shown in Plate XXIV. Results for Fin and Blue whales are charted separately, and as will be seen they show a very close correspondence. The area covered by the whale-catchers during seasons 1923–4 to 1926–7 is indicated by a fine dotted line, while that for seasons 1927–8 to 1930–1 is limited by a continuous line. The position of the main concentration in each of the four-year periods is also shown.

It will be noticed at once that in each of the species the centre of concentration has shifted some 40 or 50 miles to the east, but with the great variation between individual seasons and the comparatively short periods involved, there must be some uncertainty as to the significance of this movement. A change in the centres of concentration may clearly be brought about by a change in the position of the shoals of Euphausians on which the whales feed, and this in its turn will probably be dependent on changes in the hydrology of the area. For the later seasons some information on these subjects will be available when the surveys made by the research ships have been worked up. If, however, average conditions in the environment were comparable in the two four-year periods, it would appear that the alteration in the centres of concentration can only be explained as a response to intensive whaling: the whales have been scared and no longer venture so close to the island.

The considerable extension of the grounds during the recent four-year period, and the fact that with the same number of whale-catchers fewer whales have been taken, lends support to the generally held opinion that whales are now less abundant than formerly. The data for the two periods may be summarized as shown in Table IX.

The figures indicate heavy depletion of the stock of Fin whales and still heavier depletion of Blue whales; but in view of the short periods which are considered and the great seasonal fluctuations in abundance, they cannot be regarded as reliable and calculations derived from them can only be misleading. The greatest catch of Fin whales ever made on the South Georgia grounds (5713) was in season 1925–6, and the greatest catch of Blue whales (3670) in 1926–7. Both these maxima fall in the first of our four-year periods. The average number of catchers is approximately the same in each period; but in the second much more time was occupied in towing whales long distances to the shore stations and in consequence less time was spent in hunting.

TABLE IX

	Total number of whales taken at South Georgia stations	Average number of catchers per season	Approximate area of whaling grounds (sq. miles)	Average number of whales killed in 100 sq. miles
Fin whales				
1923–4 to 1926–7	10,252	24·75	27,500	37·3
1927–8 to 1930–1	9,301	25	50,500	18·4
Blue whales				
1923–4 to 1926–7	10,955	24·75	25,000	43·8
1927–8 to 1930–1	5,265	25	41,000	12·8

The results cannot be interpreted as giving more than a strong suggestion that there has been a large reduction in the stock, and the indication is that Blue whales have suffered more heavily than Fin. It is perhaps significant that the great development of pelagic whaling along the Weddell Sea ice-edge falls within the second four-year period and that in this area the incidence of capture falls more heavily on Blue whales.

The figures in the last column of Table IX give only the average density of whales killed on the South Georgia grounds. It will be evident that they were taken in much greater numbers in the centres of concentration and in much smaller numbers on the fringe of the whaling grounds. The greatest concentration during the eight seasons was of Fin whales in 1925–6. In April alone of this season 92 Fin whales per 100 square miles were killed a short distance from the mouth of Cumberland Bay, and in the same area the catches for the whole season amount to 2·8 Fin whales per square mile of whaling ground.

Inspection of the charts for the different seasons gives the impression that the whales generally pass across the grounds in an easterly direction. The first whales of the season are usually taken to the north or north-west of the island. As they increase in number their centres of concentration shift to the east and later, in most seasons, they move towards the southern side of the island. At the end of the season there is considerable variation in position, but the tendency is for whales to occur in the south-east. In some of the charts (Fin whales, 1928–9, Plate XII, affords the best example) the disappearance of a school in the early part of the season and its replacement by later arrivals can be traced.

The impression of a general movement towards the east is borne out in some measure by examination of the directional data, which are summarized, in the manner already explained (p. 175), in Figs. 3 and 4. If the monthly records of direction shown in these figures are resolved into their components along the four cardinal points of the compass the results are as shown in Table X.

TABLE X

	Number of monthly records	Components			
		North	East	South	West
Fin whales					
Number	57	39	43	18	14
Percentage		*34*	*37½*	*16*	*12½*
Blue whales					
Number	47	21	43	26	4
Percentage		*22*	*46*	*28*	*4*

It will be seen that in each species the highest number of components is in an easterly direction. In Fin whales there is also a strong northerly component, whereas in Blue whales the southerly component is more pronounced than the northerly.

In all the data hitherto discussed a very close correspondence has been found between the two species of whale. They concentrate in the same areas, and their movements in any season, as determined from monthly records of capture, are usually very much the same. But in these directional data differences between the two species are apparent. The most noteworthy difference is in the records for the earlier months of the season, in which Fin whales were observed to be moving towards the north, while Blue whales were moving east. In this respect the records for both species show a marked degree of consistency.

For this unexpected result we are not able to offer any satisfactory explanation. It might be thought that movements at the beginning of the season would afford an indication of the direction from which whale stocks arrive on the South Georgia grounds. The general inference from other data would be that they arrive from the west, and the strong easterly movement of Blue whales in the early months is in agreement. But it is very difficult to believe that Fin whales arrive from the south. The majority of them have almost certainly passed the winter in warmer waters to the north. If they reach South Georgia from the south, they must first have visited the South Orkney Islands: it seems most improbable that they would take so circuitous a route, and if they had done so we should expect to find that the whalers killed them on the south side of the island at the beginning of the season. The strange difference in recorded movement between the two species is thus unexplained, and it appears probable that the direction from which the schools arrive on the whaling grounds is not to be ascertained from these records.

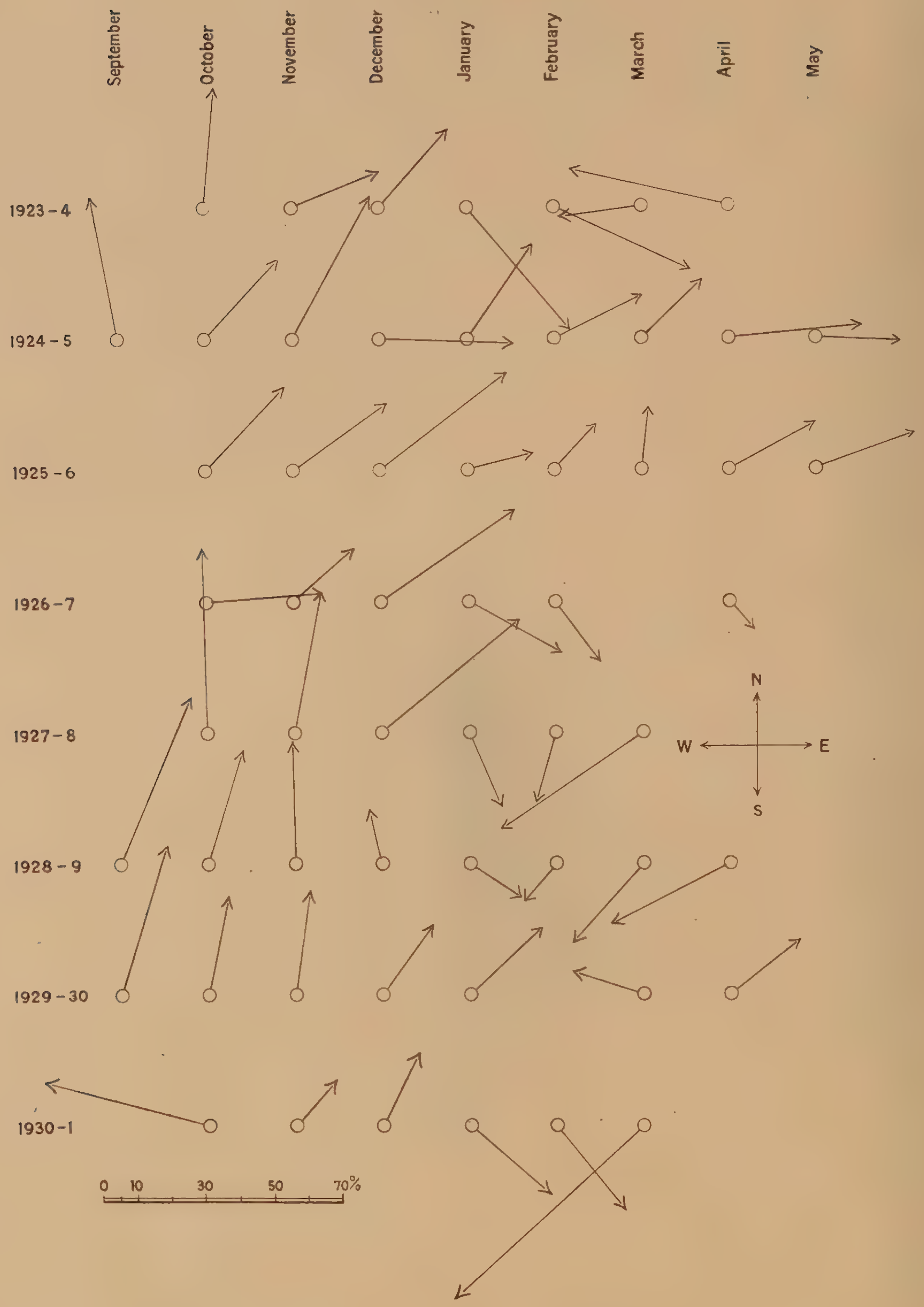

Fig. 3. Recorded movements of Fin whales on the South Georgia grounds. The direction of each arrow is the resultant direction of observed whale movements; the length of the arrow indicates, as shown in the scale, the resultant number moving in this direction, expressed as the percentage of the total.

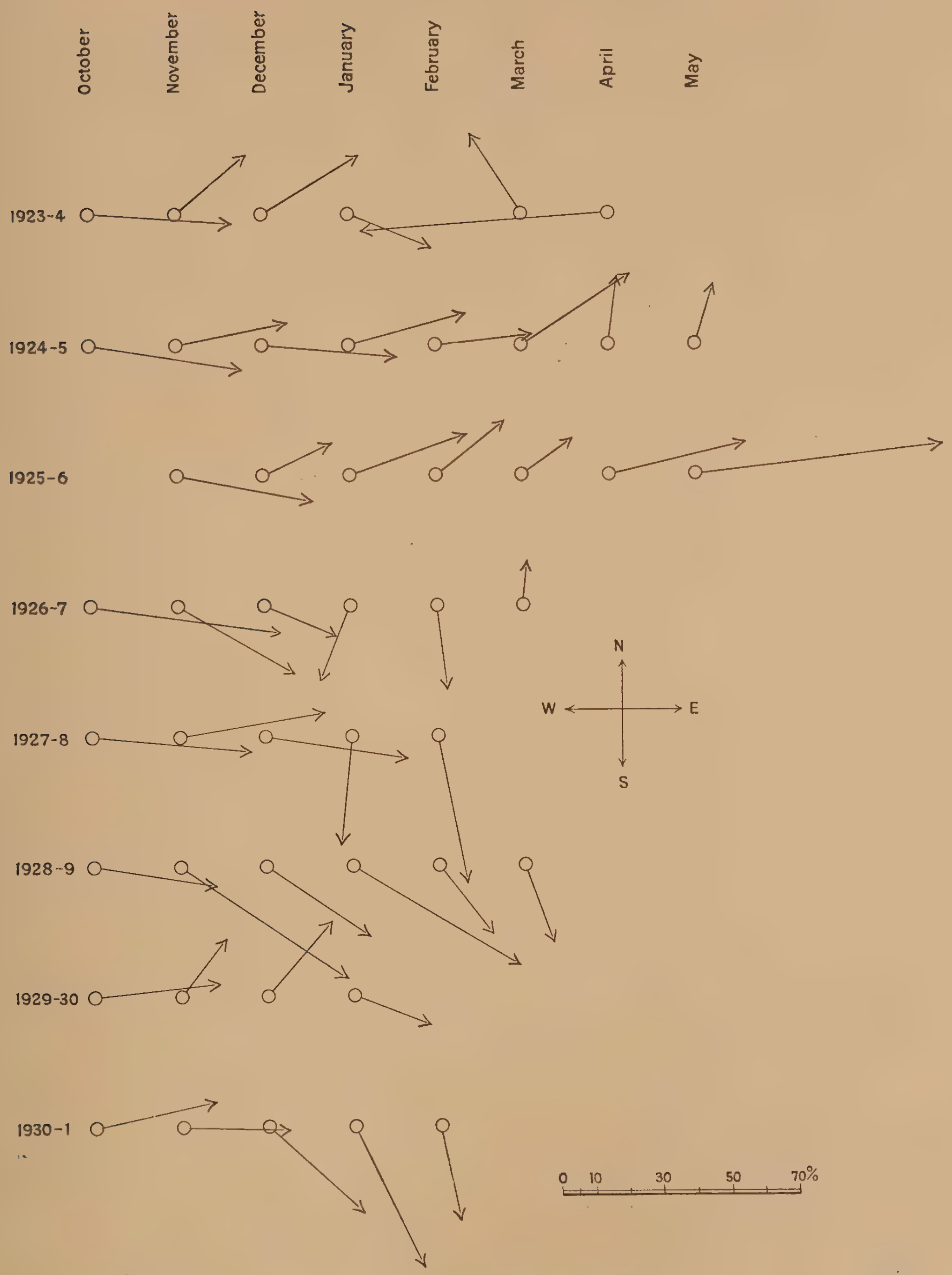

Fig. 4. Recorded movements of Blue whales on the South Georgia grounds. The direction of each arrow is the resultant direction of observed whale movements; the length of the arrow indicates, as shown in the scale, the resultant number moving in this direction, expressed as the percentage of the total.

During the middle months of the season the directional data, though giving a general movement between north-east and south-east, show great variation, and frequently there are marked differences between the two species. Seasons 1924–5 and 1925–6, which were exceptional as regards distribution, do not differ conspicuously in recorded directions, but in 1925–6 a regular north-easterly movement for both species is more clearly shown than in any other season. In the last months of the season a reversal of the general easterly trend is sometimes found. In March and April of the 1923–4 season there is a marked westerly movement of both Blue and Fin whales. A similar change in direction is also seen in the Fin whales returns for the later months of 1927–8, 1928–9 and 1930–1; for these months the Blue whale data are for the most part inadequate, and it is not possible to compare the two species.

SOUTH SHETLAND WHALING GROUNDS

The area covered by the South Shetland whalers, as will be seen from Plate XL, is very large, extending from the east and south of Clarence Island, through Bransfield Strait and south-west to the Biscoe Archipelago. The two charts in this plate incorporate all recorded positions for Blue and Fin whales over a series of eight seasons, and it will be seen that they give the same result as those from the South Georgia grounds: the distribution of the two species is closely similar and the centres of concentration occur in the same places. The two chief concentrations are at the northern and southern ends of Bransfield Strait, one east-south-east of King George Island and one south of Deception Island. There are also smaller concentrations to the west of Smith Island and north-west of Antwerp Island.

It is to be noted that the two main concentrations are not found throughout the duration of the season. The concentration off King George Island is for the most part found in the opening months of the season, while that near Deception Island usually occurs at its end.

In discussing the South Georgia results we were able to show that the position of the main concentration of whales may be explained by the hydrological conditions which prevail in the neighbourhood of the island and the accumulations of whale food which result from them. It is more difficult to account for the South Shetland concentrations on these lines. The main current in this area runs in a north-easterly direction from the Bellingshausen Sea through Drake Passage. One branch of this current enters Bransfield Strait north of Brabant Island and flows with increased speed along the northern side of the strait. On the southern side a weaker reverse current is found, and this comes from the Weddell Sea and flows round Joinville Island to take a south-westerly direction. Euphausians, both adult and young, have sometimes been found in abundance in the strait and some of the shoals may be of Weddell Sea origin. Conditions in the strait, both as regards plankton and hydrology, are very complex, and until the data obtained by the research ships has been fully worked up, no complete explanation of the problem can be attempted.

Examination of the data for individual seasons, illustrated for Fin whales in Plates XXV to XXXII and for Blue whales in Plates XXXIII to XXXIX, shows that there is very great variation in the position of the main concentrations, and it is by no means easy to ascertain the normal movements of the schools. Two points, however, seem tolerably evident. It appears (i) that the whales first appear in the northern or north-eastern parts of the area, and in the earliest months of the season are found either in the neighbourhood of Smith Island or off King George Island, and (ii) that at the extreme end of the season there is frequently a very close concentration in Bransfield Strait. In the middle of the season the concentrations show great variation and they are sometimes well to the south of these positions.

These facts, which appear on the whole to be warranted by the data, find their most simple explanation in the theory that the whales arrive on the grounds from the north or north-east, pass along the coast to the south-west and at the end of the season return towards the north-east. The data bearing on this theory can best be examined by incorporating all the returns for each month in a single chart: this has been done for Fin whales in Plate XLI and for Blue whales in Plate XLII.

Considering first the Blue whales, it will be seen that the species arrives on the grounds in November,[1] increases in number in December, and that by January the concentrations have shifted decisively towards the south-west. In February and March the whales remain rather widely dispersed over the same area, but in April there is a heavy concentration in Bransfield Strait.

The monthly aggregates for Fin whales (Plate XLI) are similar to those for Blue; but the species arrives later at the South Shetlands, not appearing in any numbers until December, and the schools do not move so far south as those of the related species. In April there is the same heavy concentration in Bransfield Strait.

The Blue whale is known to go farther south than the Fin; it is most plentiful in the neighbourhood of pack-ice and the distance that it travels on its southern migration is no doubt determined by the latitude of the ice-edge—a factor which varies greatly from season to season. In some years therefore, when the pack-ice is well to the north, Blue whales may be expected to remain in the South Shetland area, whereas in others, with the ice-edge far to the south, the majority of them may pass through the grounds and for a time will be beyond the reach of the whalers. The movements of Fin whales are also in all probability determined in some measure by the position of the ice-edge; but since the normal distribution of this species lies a little to the north of that of the Blue, the Fin whales will less often penetrate beyond the limits of the whaling area. That such a movement as this can actually occur appears to be indicated by events which occurred in the 1925–6 season. The statistics of South Shetland whaling published by Harmer[2] show that in this season the monthly catches of both Blue and Fin whales yield a conspicuously bimodal graph, with peaks in December and April for Blue whales and in January and

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[1] In some seasons Blue whales have been taken in October, but the numbers of recorded positions are so few that this month has not been included in Plate XLII.

[2] Harmer, *Southern Whaling*, Proc. Linn. Soc. London, 1931, pp. 114, 159, graph 4.

March for Fin whales. Blue whales were scarce in February and March and Fin whales in February, facts which are also indicated in Plates XXVIII and XXXVI. In this season at least there are grounds for believing that the whales travelled south beyond the whaling area and again passed through it on their return to the north.

The year 1925–6, as Harmer has pointed out, was clearly an exceptional one: it is only in this season that a bimodal graph is found in both the species. But there is some reason for supposing that it is only in exceptional conditions that whale movements can be indicated by the available data. Though we have little exact information on the behaviour of whales which visit the South Shetlands, it may be assumed that they do not differ appreciably from those at South Georgia. The whales, no doubt, do not arrive in a regular flow, but appear from time to time, in schools of greater or less concentration in which one or other sex may predominate. Schools which arrive first will probably travel farthest and in a normal year some of them, which have passed beyond the whaling limits, will be replaced by later arrivals from the north. If this view is correct the indications to be derived from monthly charts of distribution must necessarily be blurred and indistinct; and since the whalers pursue their quarry along several hundred miles of coast-line, statistics will usually give no hint of movement. Only in an exceptional season, when the greater part of the stock is for a time inaccessible to the whalers, can we hope to obtain precise information.

In the season 1925–6 the whalers penetrated south-west as far as the Biscoe Archipelago, and here, in December, they obtained a few Blue whales. That they went so far is evidence that the pack-ice lay well to the south and that whales were not abundant to the north. During the period under review there is only one other season when the whalers extended their operations so far to the south-west. This was in season 1923–4, when both Blue and Fin whales were taken in some numbers at the extreme south-western limit of the area (Plates XXVI, XXXIV). It is to be imagined that in this season also the pack-ice lay far to the south and one would expect, therefore, that the monthly catches would show early and late maxima as in 1925–6. The statistics given by Harmer indicate that Blue whales reached their peak in December and Fin whales in January and February, but in neither species did a second maximum occur. The absence of the second peak is perhaps to be attributed to unusual whale movements at the end of the season. In 1923–4 the customary autumn concentration in Bransfield Strait did not occur, and it appears that the whales took a different route when leaving the grounds, perhaps going due north from Smith Island.

The charts for the individual seasons indicate that the movements of the whale schools may differ rather considerably. If the grounds are not approached directly from the north (when whales first appear off Smith Island), they are generally taken in the early months of the season at the northern end of Bransfield Strait and pass through the strait on their passage south. This is to be seen for Fin whales in 1924–5 and 1925–6 (Plates XXVII, XXVIII), and for Blue whales in 1922–3 and 1925–6 (Plates XXXIII and XXXVI). Occasionally, however, as in Fin whales, 1926–7 and 1927–8 (Plates XXIX, XXX), and in Blue whales 1926–7 (Plate XXXVII), they appear to have avoided the strait, passing outside the South Shetland Islands. Towards the close of the season a concentration at the southern end of Bransfield Strait is the general rule, the whales presumably passing up through it on their northward migration. Sometimes, however, this concentration was absent. As already noted it was not found in 1923–4, when both Fin and Blue whales appear to have gone directly towards the north, and in the following season a considerable proportion of Fin whales seem also to have avoided the strait.

The south-western limits of the whaling grounds extend to the Biscoe Archipelago, but this locality was only reached by the whalers in seasons 1923–4 and 1925–6. It is to be presumed that in both these seasons the pack-ice in the Bellingshausen Sea lay unusually far to the south. Season 1929–30 was an exceptionally open one in the Weddell Sea. The vessels of the Weddell Sea fleet reached very high latitudes and those of the South Shetland fleet—for the only time during the period under review—were able to work east and south-east of Joinville Island. This is shown for Fin whales in Plate XXXII. Blue whale returns for this season are so few that monthly charts cannot usefully be given, but the data are included in the totals shown in Plate XL in order that the distribution of the two species can be compared.

Whales do not appear to occur in such dense concentrations in the South Shetlands as in South Georgia. During the eight seasons reviewed the greatest concentration—as shown by the number taken by the whalers—was of Fin whales in Bransfield Strait in April 1927. In an area of 828 sq. miles 229 whales were killed during this month, or 27·7 whales per 100 sq. miles. This is less than one-third the maximum density found on the South Georgia grounds (see p. 180), but the two figures are not strictly comparable.

The directional data from the South Shetlands have been summarized in the same way as those from South Georgia and the results are shown in Figs. 5 and 6. They are, if anything, less consistent than the South Georgia results, and their validity, as already explained, is open to question. In Table XI the numbers of components along the four cardinal points are given, and since a reverse movement is to be anticipated in the latter half of the season, the numbers for each species are grouped in two series—the first series running from November to January and the second from February to April or May.

It cannot be said that these data give any clear support to the theory that whales normally travel south-west in the first part of the season and north-east in the latter part. Such a result is, however, to be found in the Blue whale records for 1924–5 and 1925–6 and with less certainty in the Fin whale records for 1922–3 and 1924–5 (see Figs. 5, 6). In all other seasons no agreement with this theory is to be found.

Table XI shows that in these data the predominant component throughout the season is the westerly, the only exception being in Fin whales, where in the latter half of the season the northerly component is in slight excess. If, however, the first half of the season is compared with the second it will be seen that in the latter the numbers of southerly and westerly components have diminished and the northerly and easterly have increased. Only in this respect do the figures bear out the theoretical movement inferred from the positional data.

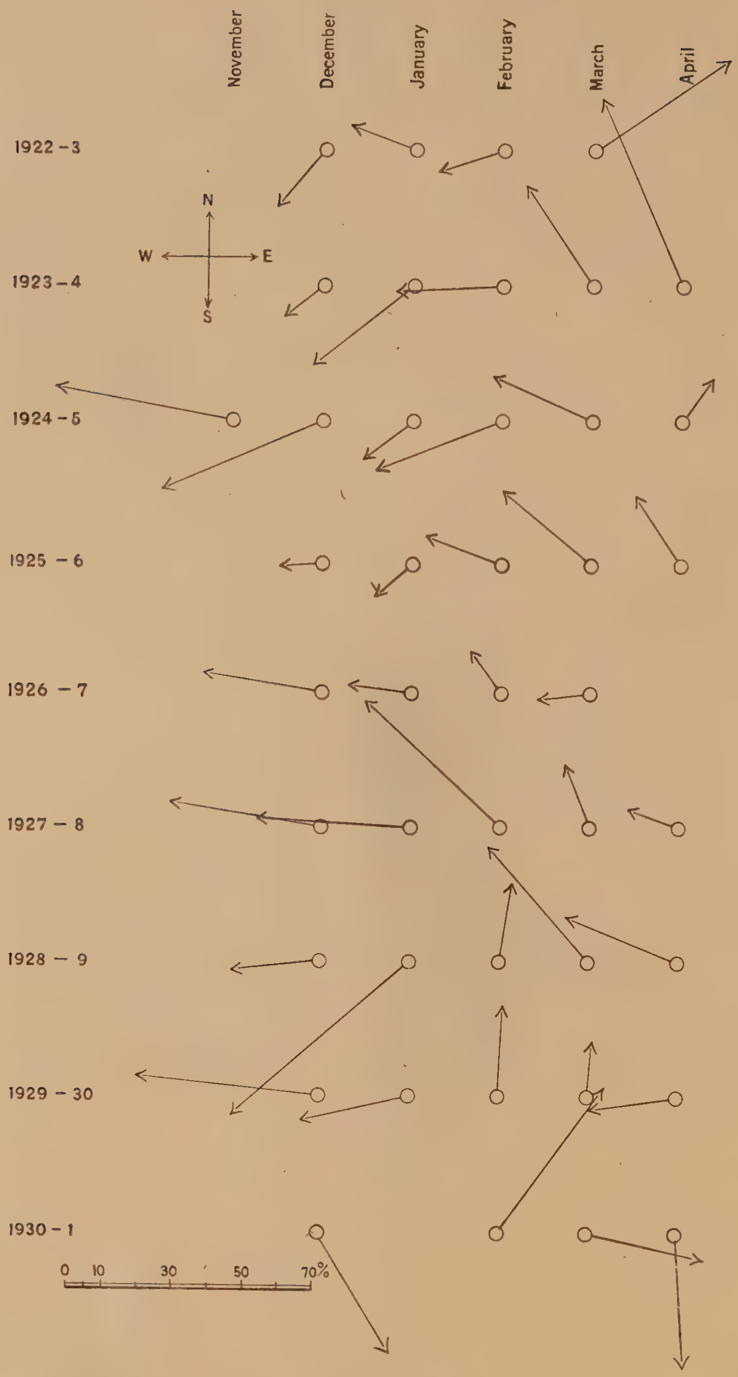


Fig. 5. Recorded movements of Fin whales on the South Shetland grounds. The direction of each arrow is the resultant direction of observed whale movements; the length of the arrow indicates, as shown in the scale, the resultant number moving in this direction, expressed as the percentage of the total.

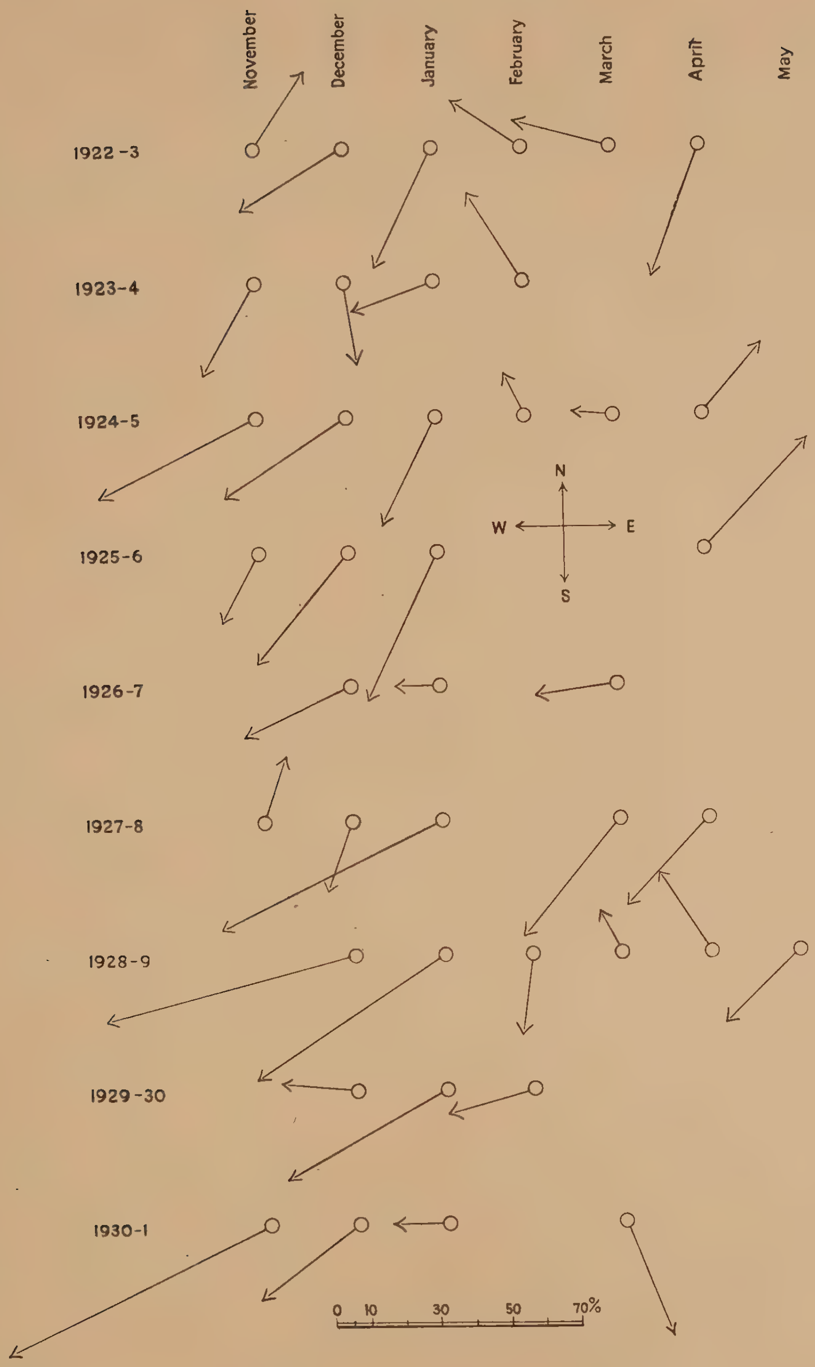


Fig. 6. Recorded movements of Blue whales on the South Shetland grounds. The direction of each arrow is the resultant direction of observed whale movements; the length of the arrow indicates, as shown in the scale, the resultant number moving in this direction, expressed as the percentage of the total.

TABLE XI

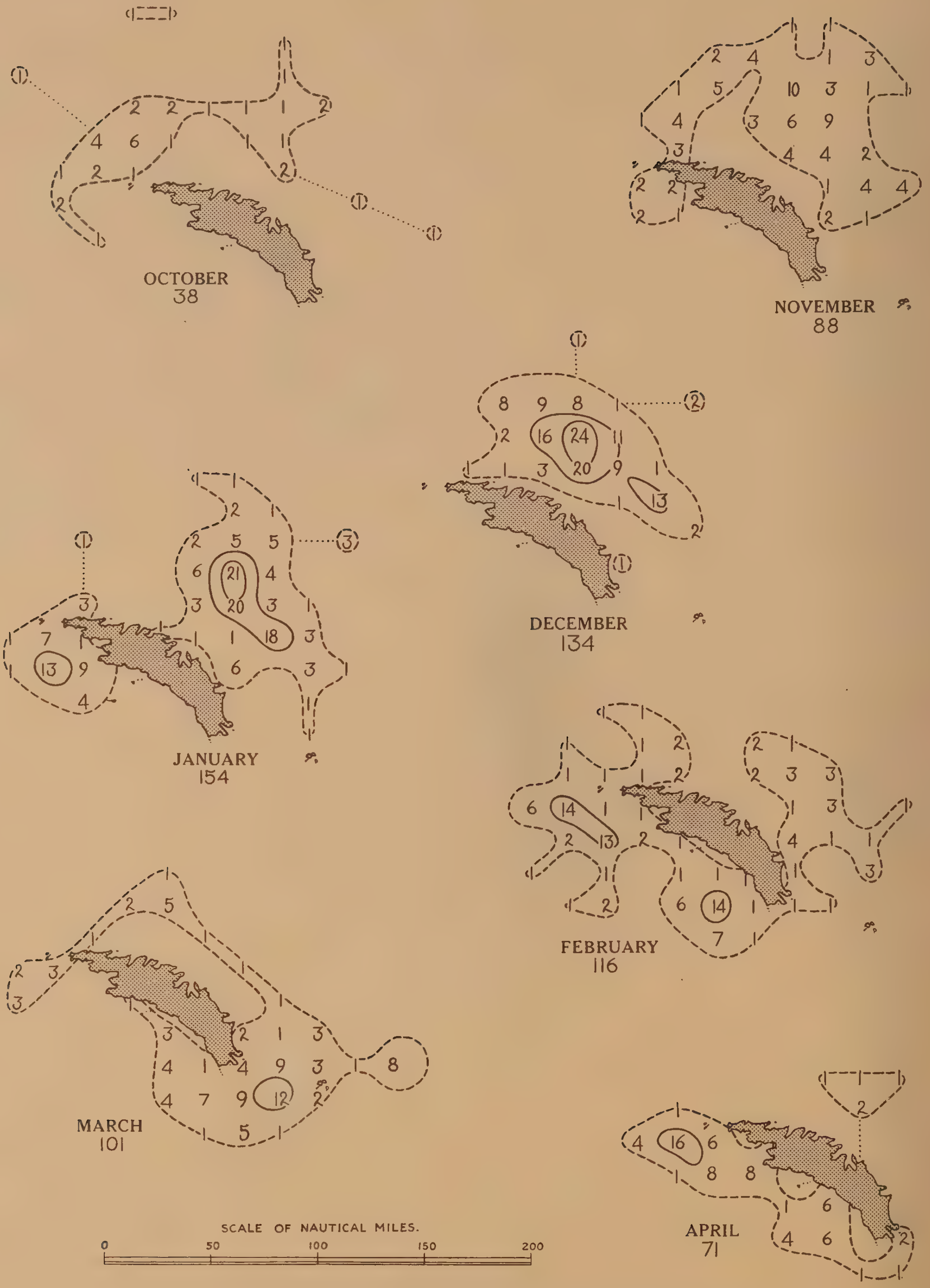
	Number of monthly records	Components			
		North	East	South	West
Fin whales					
November to January					
Number	18	7	1	11	17
Percentage		*19*	*3*	*31*	*47*
February to April					
Number	25	18	8	7	17
Percentage		*36*	*16*	*14*	*34*
Blue whales					
November to January					
Number	24	3	3	19	21
Percentage		*6½*	*6½*	*41*	*46*
February to May					
Number	17	9	3	8	14
Percentage		*26½*	*9*	*23½*	*41*

If, in the middle of the season, some schools of whales were still moving south, while others had commenced their return journey, we should expect the resultant values during this period to be low, for the movements in opposite directions will partially or wholly cancel one another. This is seen with some clearness in the Blue whale data for 1924–5 and 1925–6 (Fig. 6) and also in some other seasons, but with subsequent directions which do not accord with our theory of movement.

The data for the first half of the season are more consistent than those for the latter half. They indicate that, in general, Blue whales were moving south-westerly, whereas in Fin whales the direction is more westerly, with the southerly component less strongly marked. Similar but more striking directional differences between the two species were found in the early part of the season at South Georgia, and in neither locality is it possible to suggest an explanation.

In the present state of our knowledge little help is to be derived from these data. While they give no clear support to the theory of movement based on the charts of distribution, they do not point to the probability of any different theory. They tend rather to imply that whale movements in the South Shetland area are haphazard and irregular and that no ordered principle of migration is to be discovered; and we think this conclusion most improbable.

PLATES VII–XLII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NOVEMBER
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DECEMBER
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JANUARY
154
FEBRUARY
116
MARCH
101
APRIL
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SCALE OF NAUTICAL MILES.
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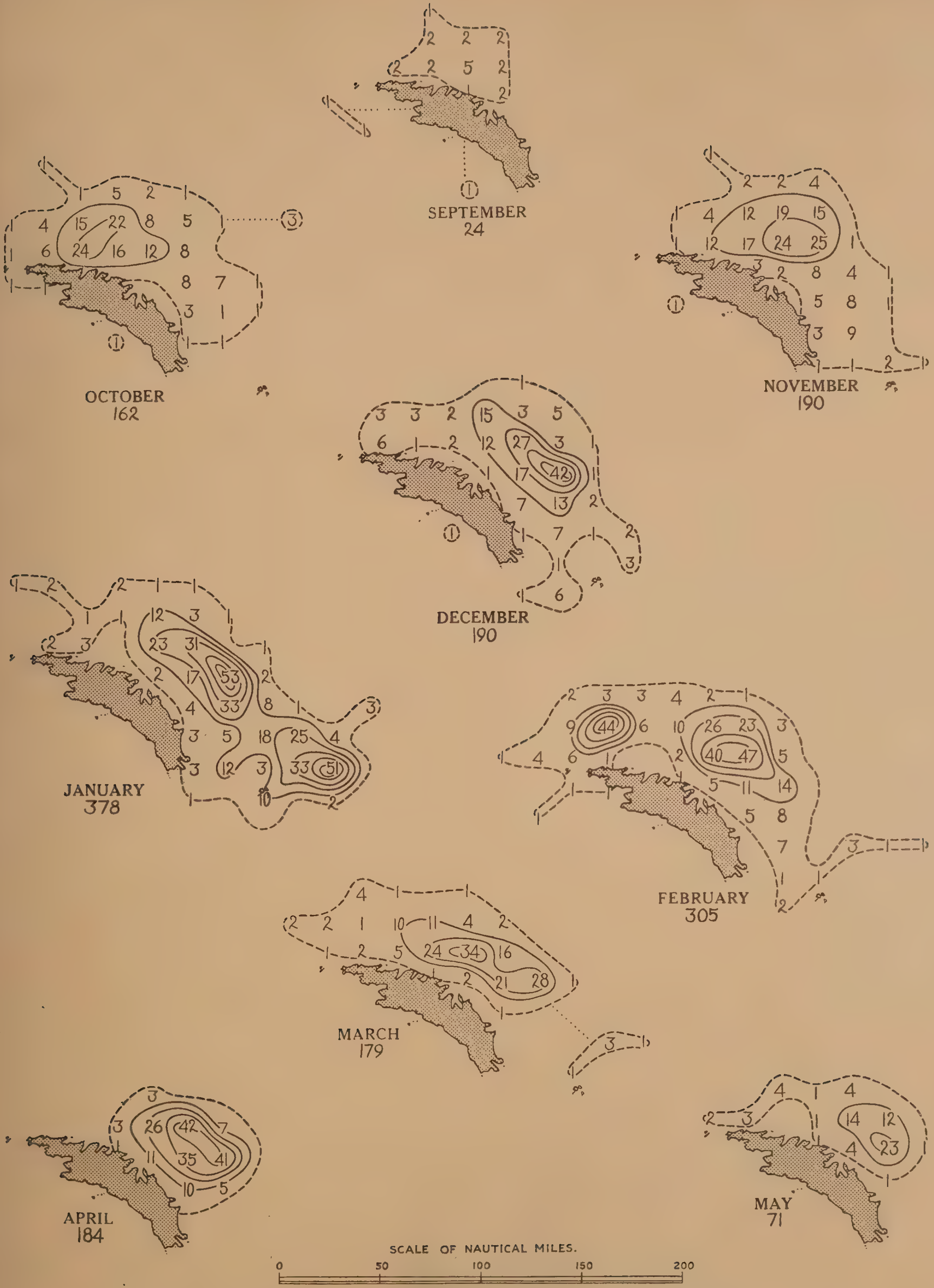
50
100
150
200

Distribution of Fin whales taken on the South Georgia grounds in season 1923–4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OCTOBER
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NOVEMBER
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DECEMBER
190
JANUARY
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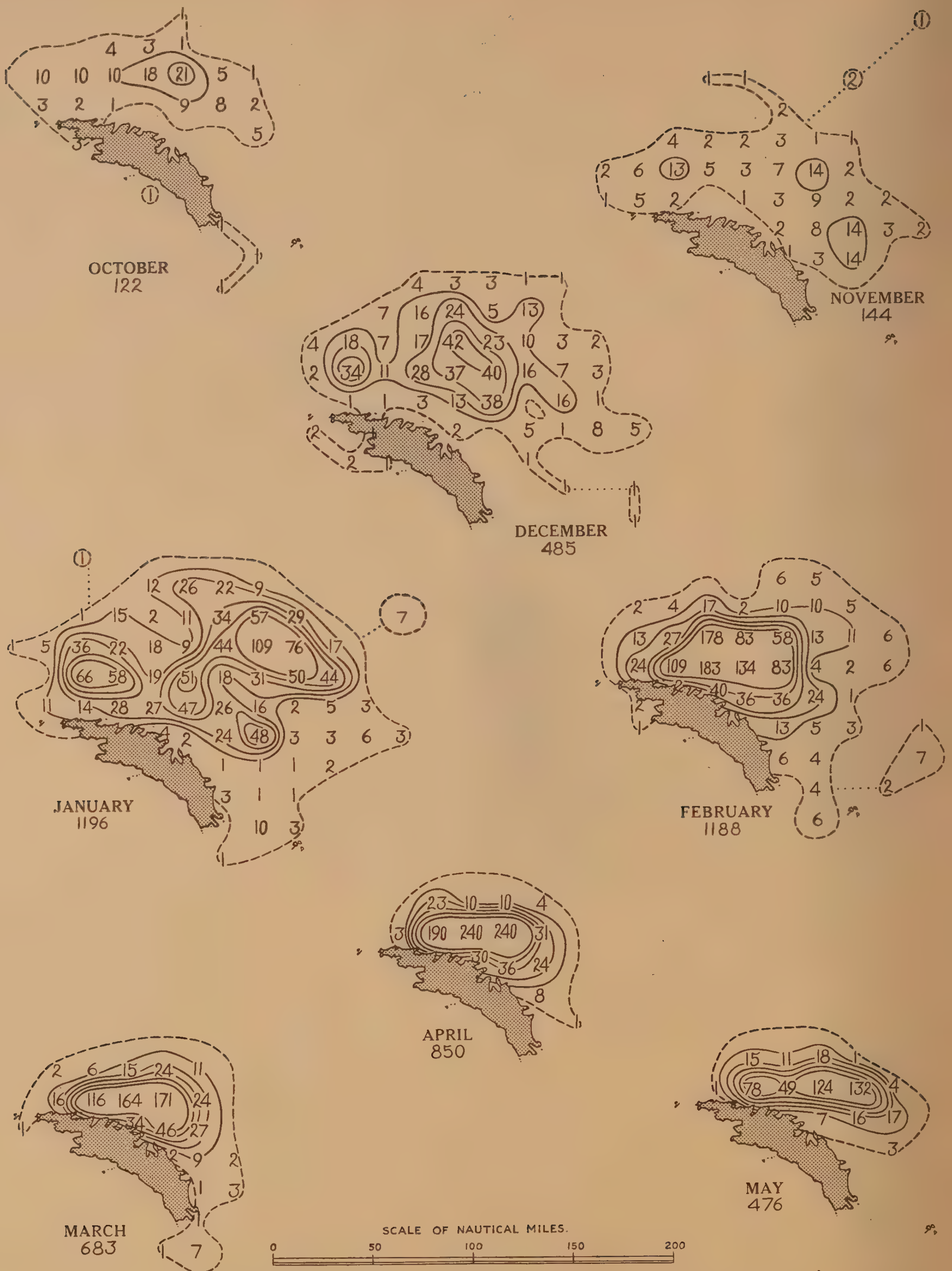
FEBRUARY
305
MARCH
179
APRIL
184
MAY
71
SCALE OF NAUTICAL MILES.
0
50
100
150
200

Distribution of Fin whales taken on the South Georgia grounds in season 1924–5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5
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1
1
2
1 1
2
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2 8 14 3 2
1 3 14
4 3 3 1
7 16 24 5 13
4 18 7 17 42 23 10 3 2
2 34 11 28 37 40 16 7 3
1 1 3 13 38 16 1
2 2 5 1 8 5
2 1
1
12 26 22 9
1 15 2 11 34 57 29 7
1 5 36 22 18 9 44 109 76 17
66 58 19 51 18 31 50 44
11 14 28 27 47 26 16 2 5 3
2 24 48 3 3 6 3
1 1 1 2
3 1 1
10 3
1
6 5
2 4 17 2 10 10 5
13 27 178 83 58 13 11 6
24 109 183 134 83 4 2 6
2 40 36 36 24 1
2 13 5 3
1
6 4
4 2 7
6
23 10 10 4
3 190 240 240 31
30 36 24
8
1
2 6 15 24 11
16 116 164 171 24
1 34 46 27
2 9 2
1 3
7
1
15 11 18 1
78 49 124 132 4
7 16 17
3
SCALE OF NAUTICAL MILES.
0 50 100 150 200

OCTOBER
122

NOVEMBER
144

DECEMBER
485

JANUARY
1196

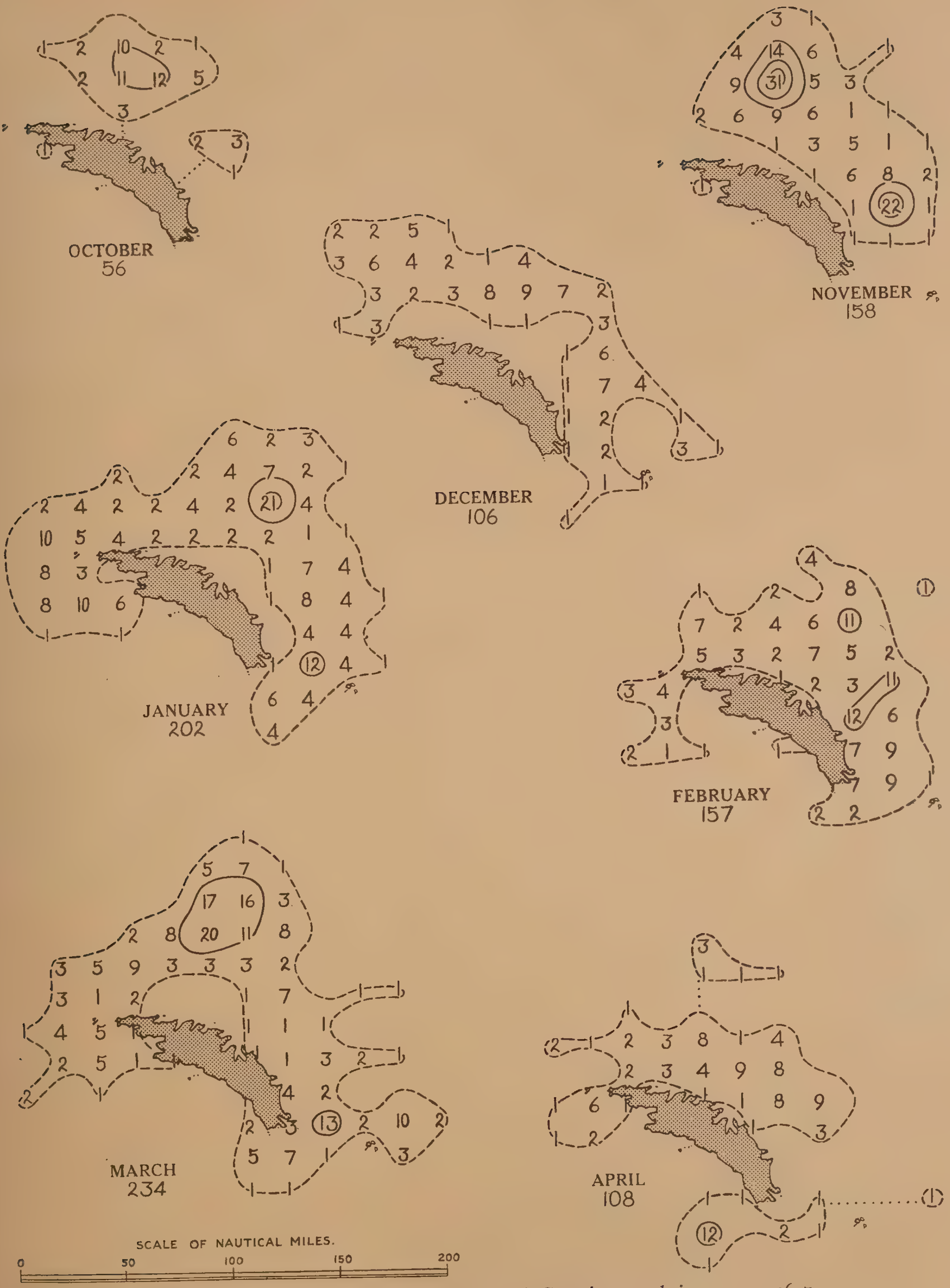
FEBRUARY
1188

APRIL
850

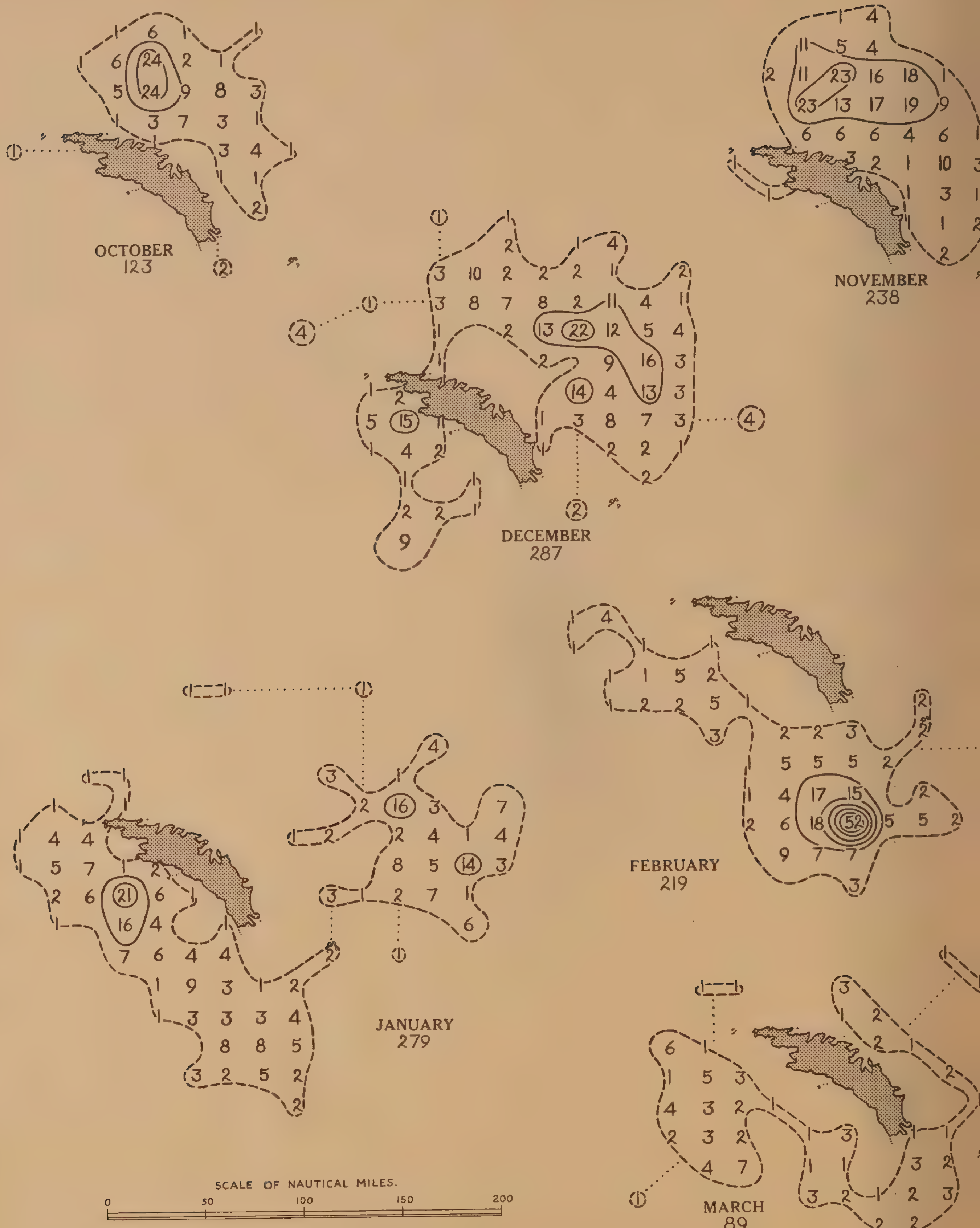
MARCH
683

MAY
476

Distribution of Fin whales taken on the South Georgia grounds in season 1925–6


OCTOBER
56
NOVEMBER
158
DECEMBER
106
JANUARY
202
FEBRUARY
157
MARCH
234
APRIL
108
SCALE OF NAUTICAL MILES.
0
50
100
150
200

Distribution of Fin whales taken on the South Georgia grounds in season 1926–7



OCTOBER
123

NOVEMBER
238

DECEMBER
287

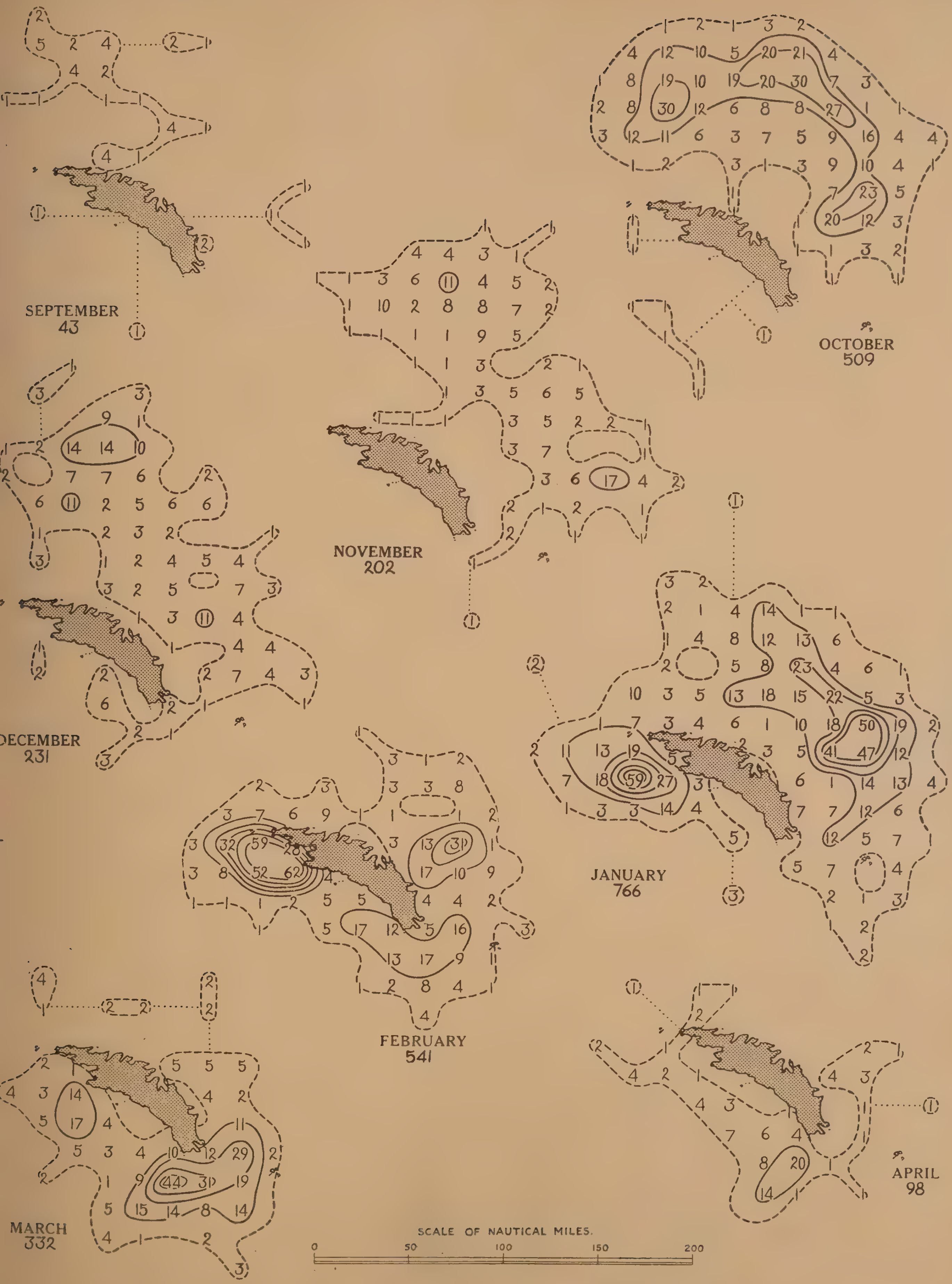
JANUARY
279

FEBRUARY
219

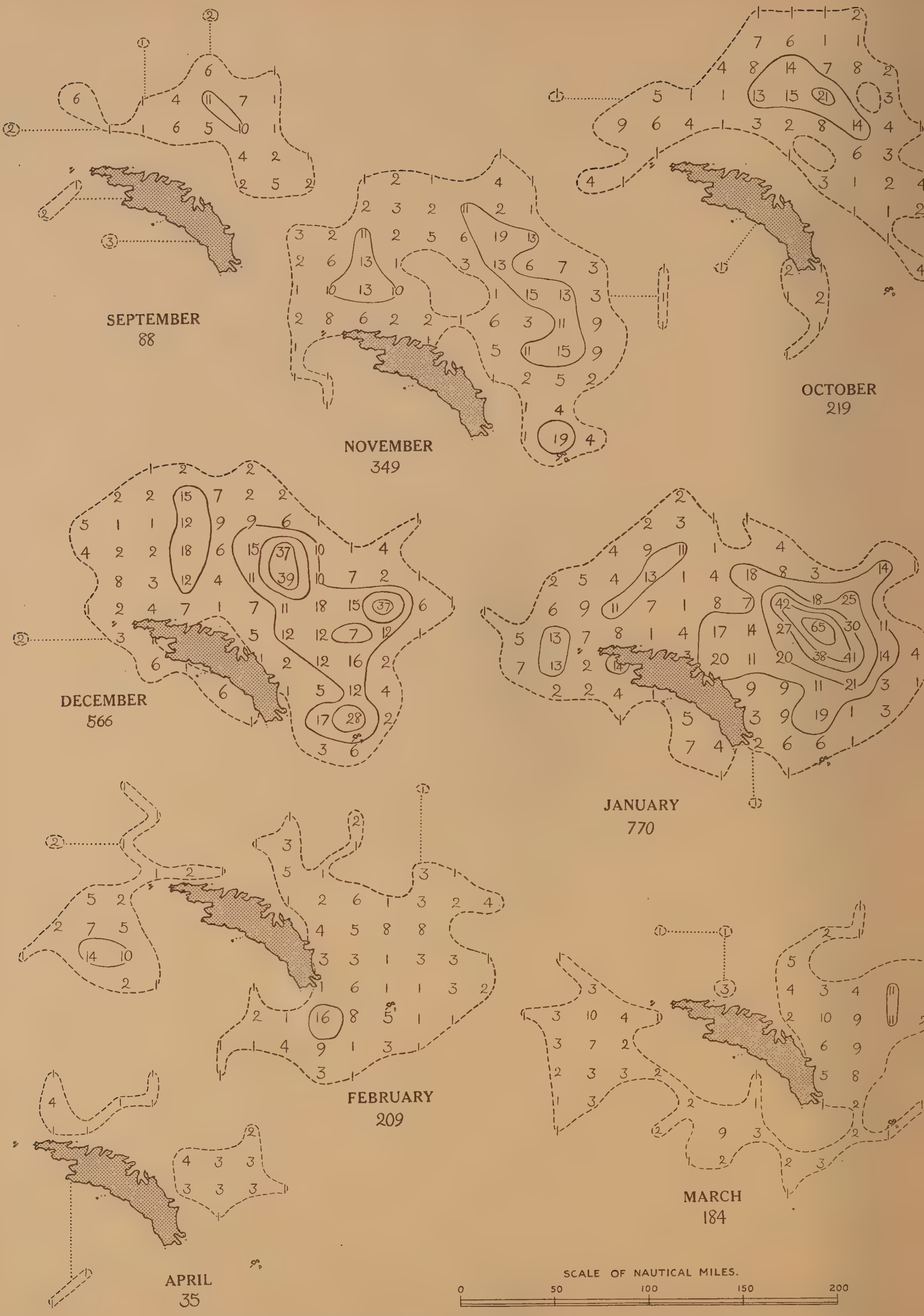
MARCH
89

SCALE OF NAUTICAL MILES.
0
50
100
150
200

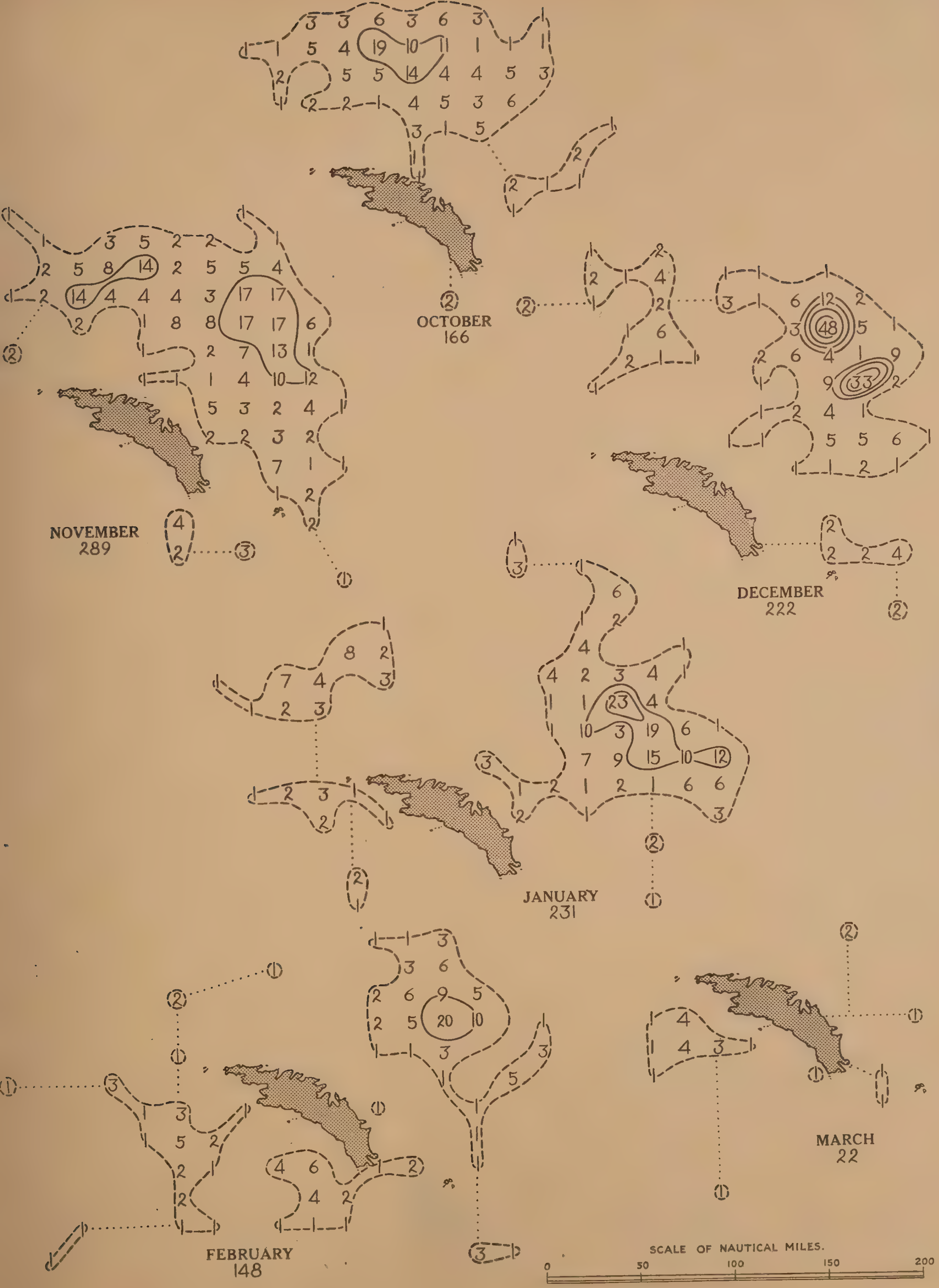
Distribution of Fin whales taken on the South Georgia grounds in season 1927–8


SEPTEMBER
43
OCTOBER
509
NOVEMBER
202
DECEMBER
231
JANUARY
766
FEBRUARY
541
MARCH
332
APRIL
98
SCALE OF NAUTICAL MILES.
0
50
100
150
200

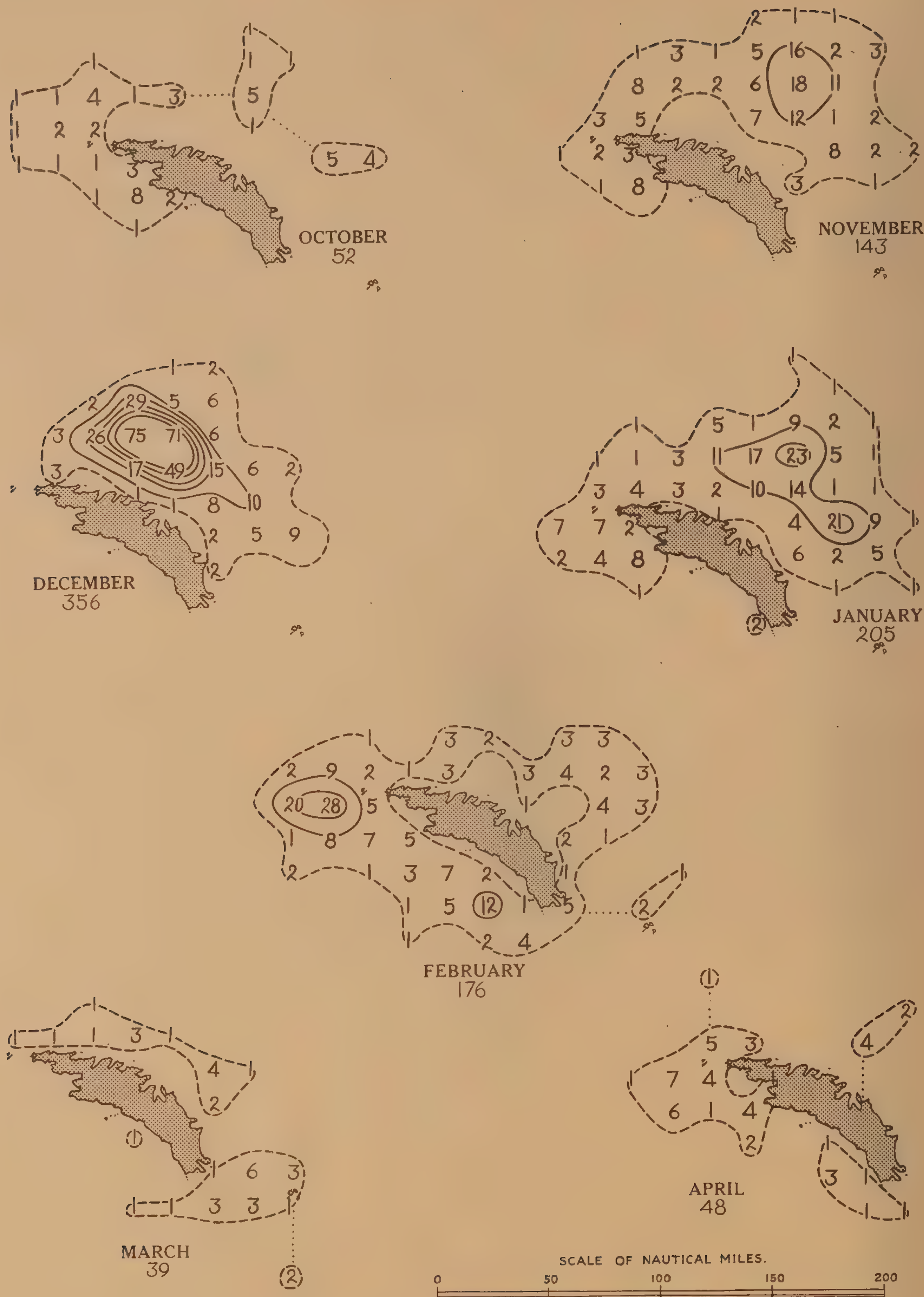
Distribution of Fin whales taken on the South Georgia grounds in season 1928–9


SEPTEMBER
88
OCTOBER
219
NOVEMBER
349
DECEMBER
566
JANUARY
770
FEBRUARY
209
MARCH
184
APRIL
35
SCALE OF NAUTICAL MILES.
0
50
100
150
200

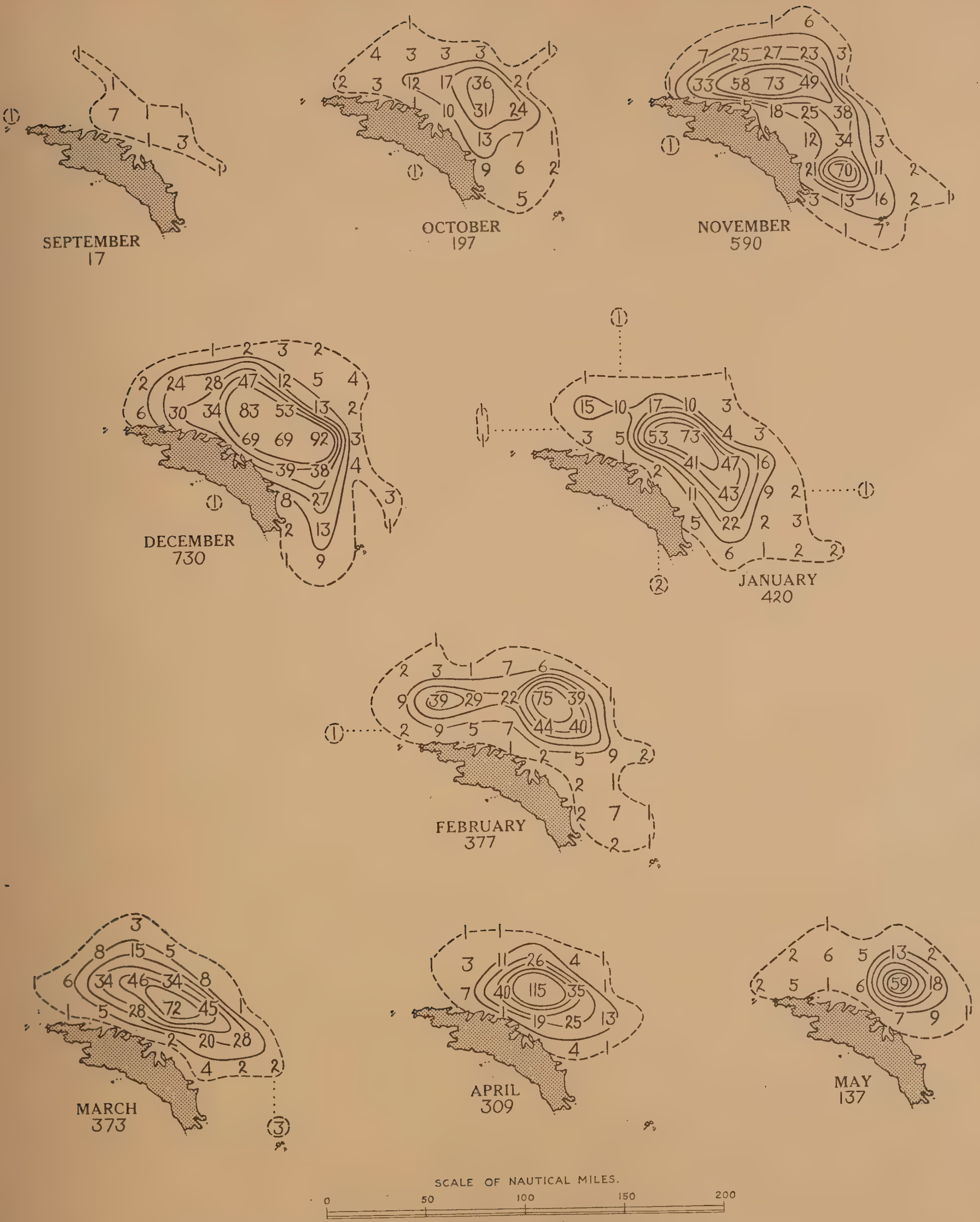
Distribution of Fin whales taken on the South Georgia grounds in season 1929–30


OCTOBER
166
NOVEMBER
289
DECEMBER
222
JANUARY
231
FEBRUARY
148
MARCH
22
SCALE OF NAUTICAL MILES.
0
50
100
150
200

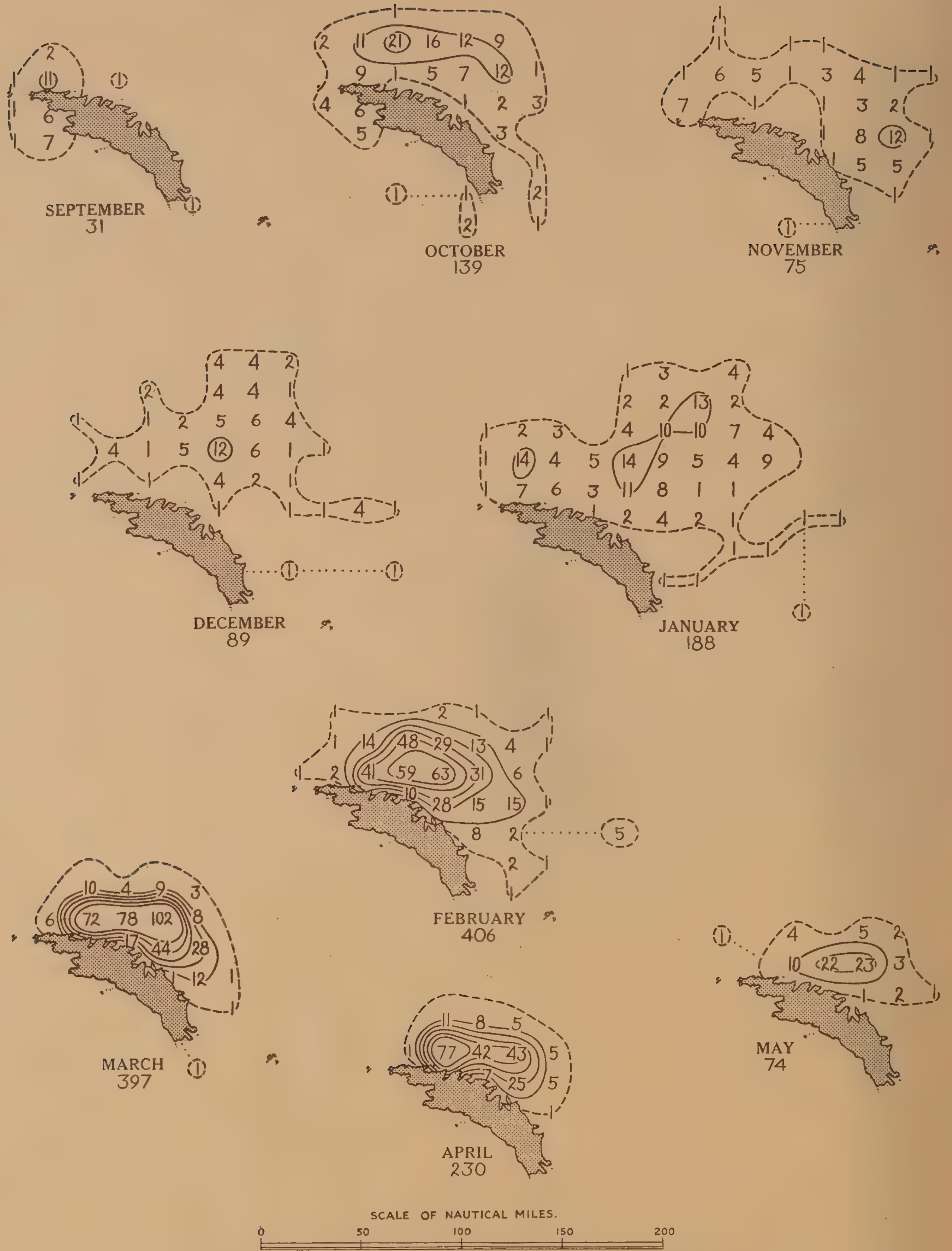
Distribution of Fin whales taken on the South Georgia grounds in season 1930–1


OCTOBER
52
NOVEMBER
143
DECEMBER
356
JANUARY
205
FEBRUARY
176
MARCH
39
APRIL
48
SCALE OF NAUTICAL MILES.
0
50
100
150
200

Distribution of Blue whales taken on the South Georgia grounds in season 1923–4


SEPTEMBER
17
OCTOBER
197
NOVEMBER
590
DECEMBER
730
JANUARY
420
FEBRUARY
377
MARCH
373
APRIL
309
MAY
137
SCALE OF NAUTICAL MILES.
0
50
100
150
200

Distribution of Blue whales taken on the South Georgia grounds in season 1924–5



SEPTEMBER 31

OCTOBER 139

NOVEMBER 75

DECEMBER 89

JANUARY 188

FEBRUARY 406

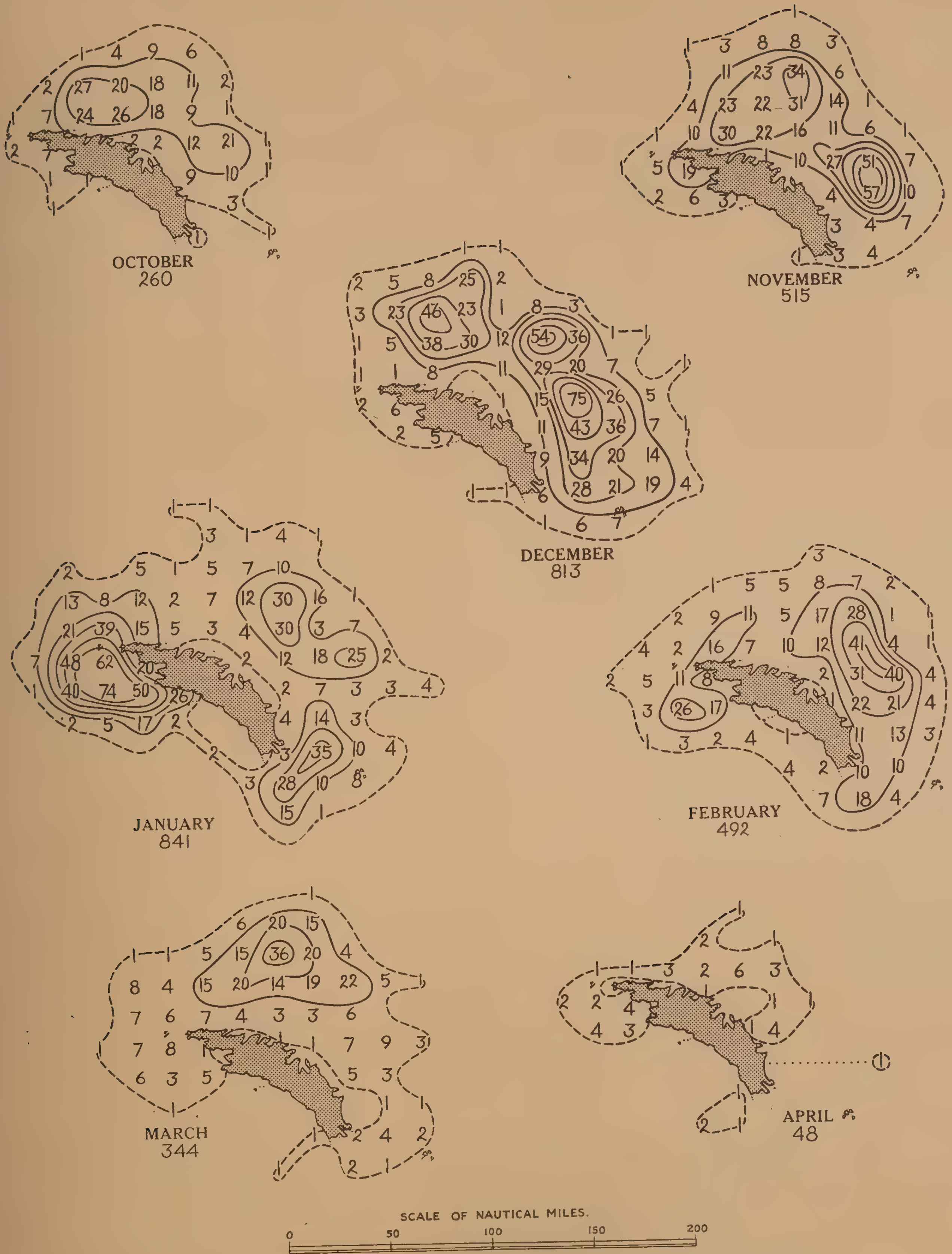
MARCH 397

APRIL 230

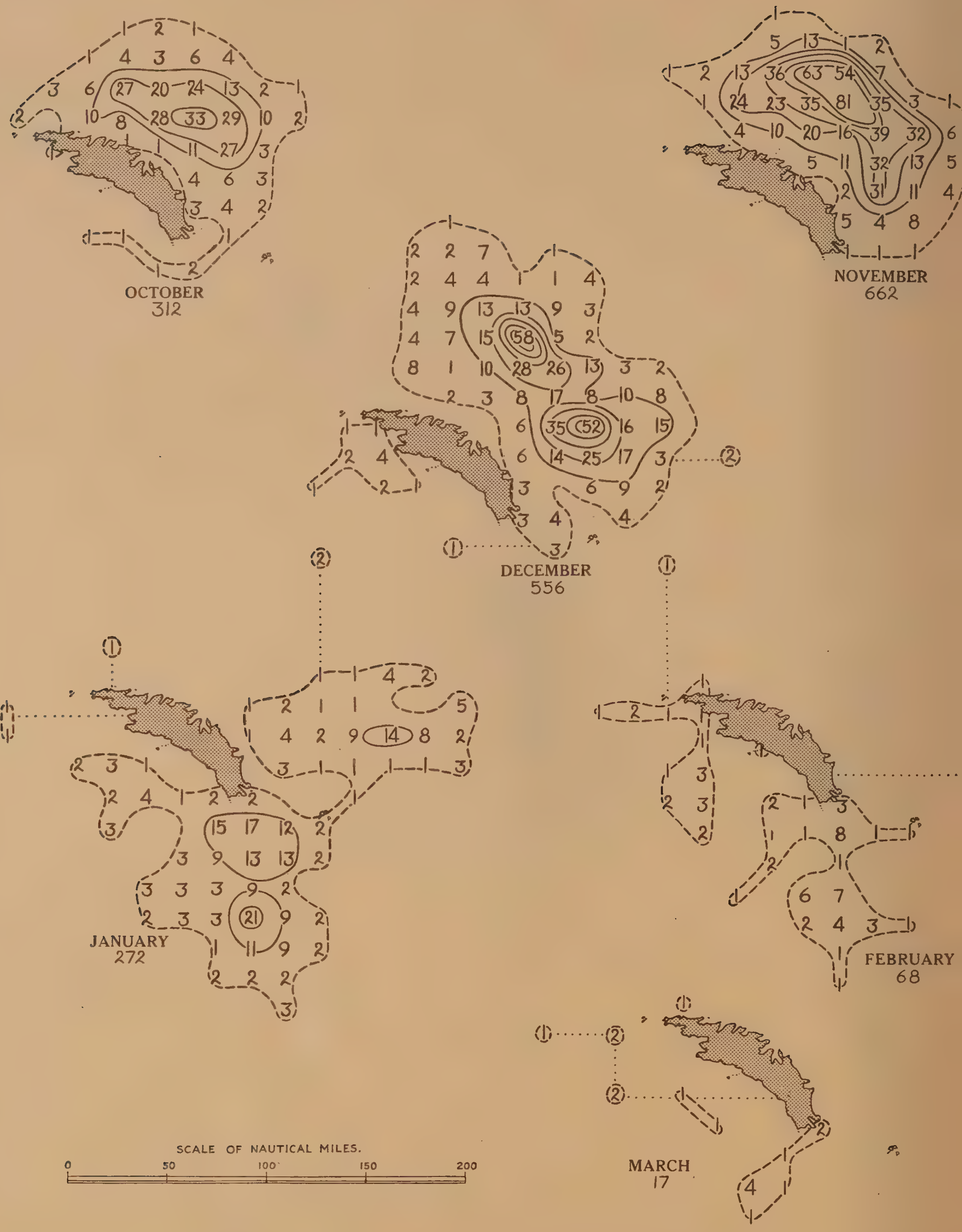
MAY 74

SCALE OF NAUTICAL MILES.
0
50
100
150
200

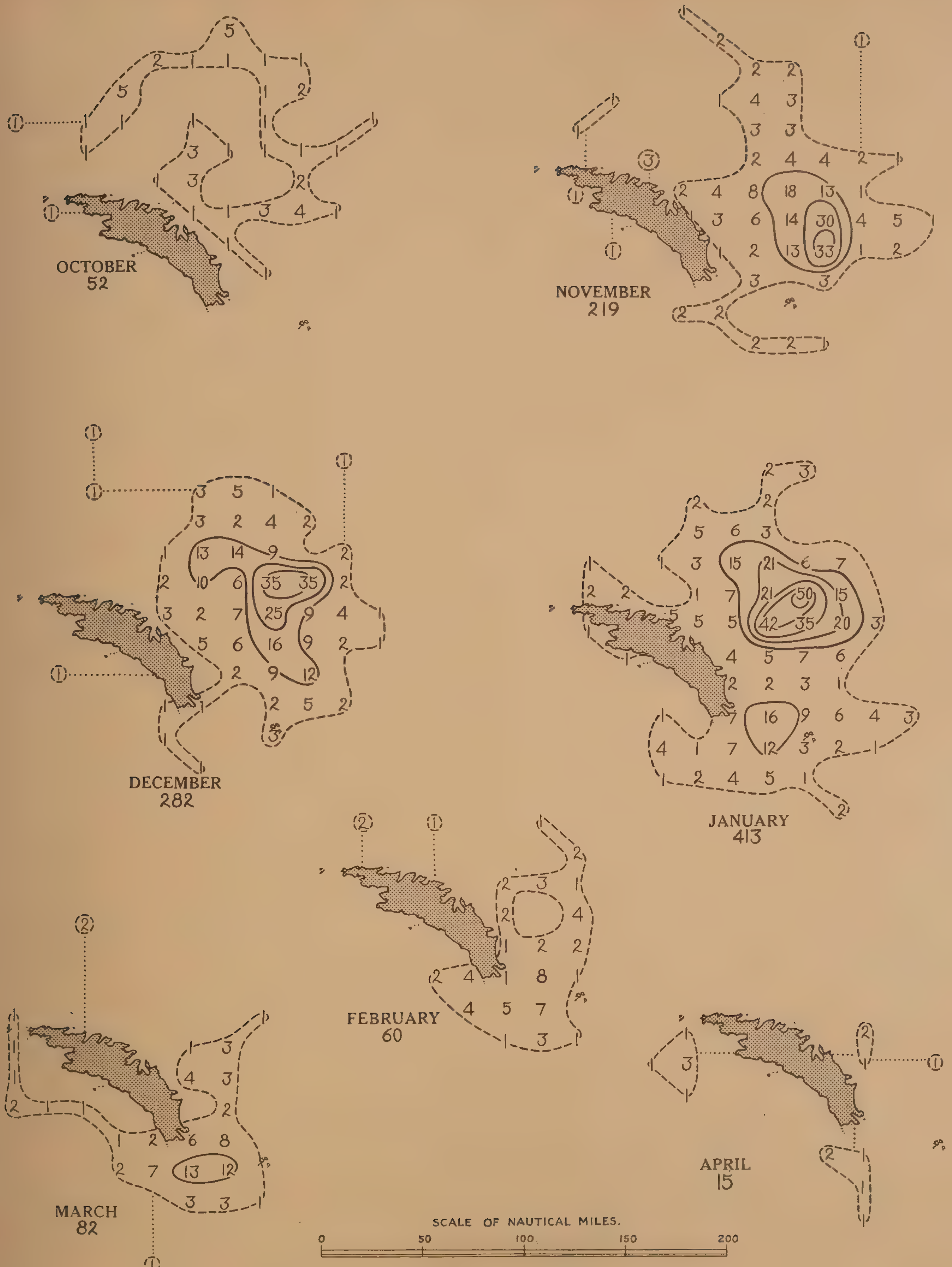
Distribution of Blue whales taken on the South Georgia grounds in season 1925–6


OCTOBER
260
NOVEMBER
515
DECEMBER
813
JANUARY
841
FEBRUARY
492
MARCH
344
APRIL
48
SCALE OF NAUTICAL MILES.
0
50
100
150
200

Distribution of Blue whales taken on the South Georgia grounds in season 1926–7


OCTOBER
312
NOVEMBER
662
DECEMBER
556
JANUARY
272
FEBRUARY
68
MARCH
17
SCALE OF NAUTICAL MILES.
0
50
100
150
200

Distribution of Blue whales taken on the South Georgia grounds in season 1927–8



OCTOBER 52

NOVEMBER 219

DECEMBER 282

JANUARY 413

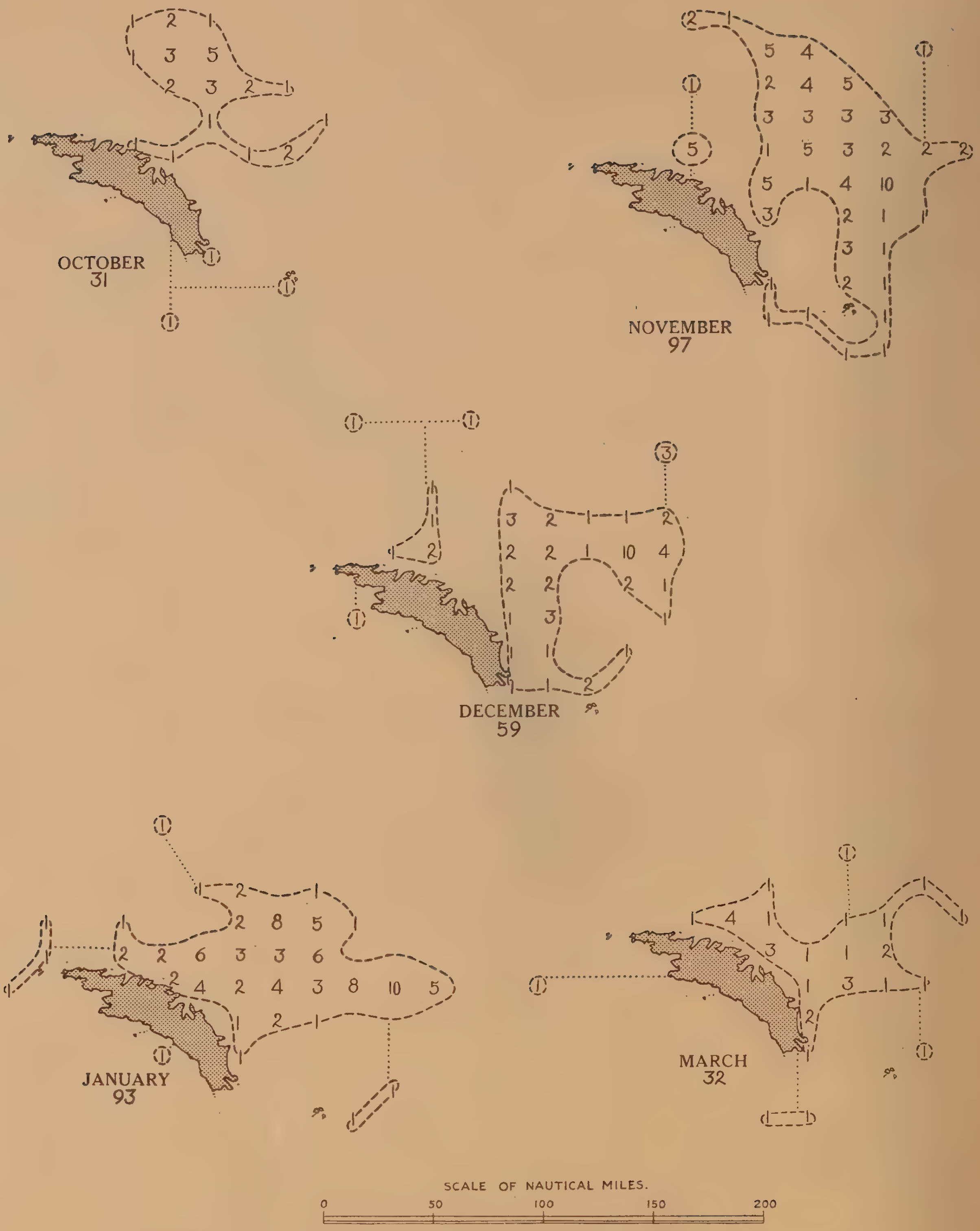
FEBRUARY 60

MARCH 82

APRIL 15

SCALE OF NAUTICAL MILES.
0
50
100
150
200

Distribution of Blue whales taken on the South Georgia grounds in season 1928–9



OCTOBER 31

NOVEMBER 97

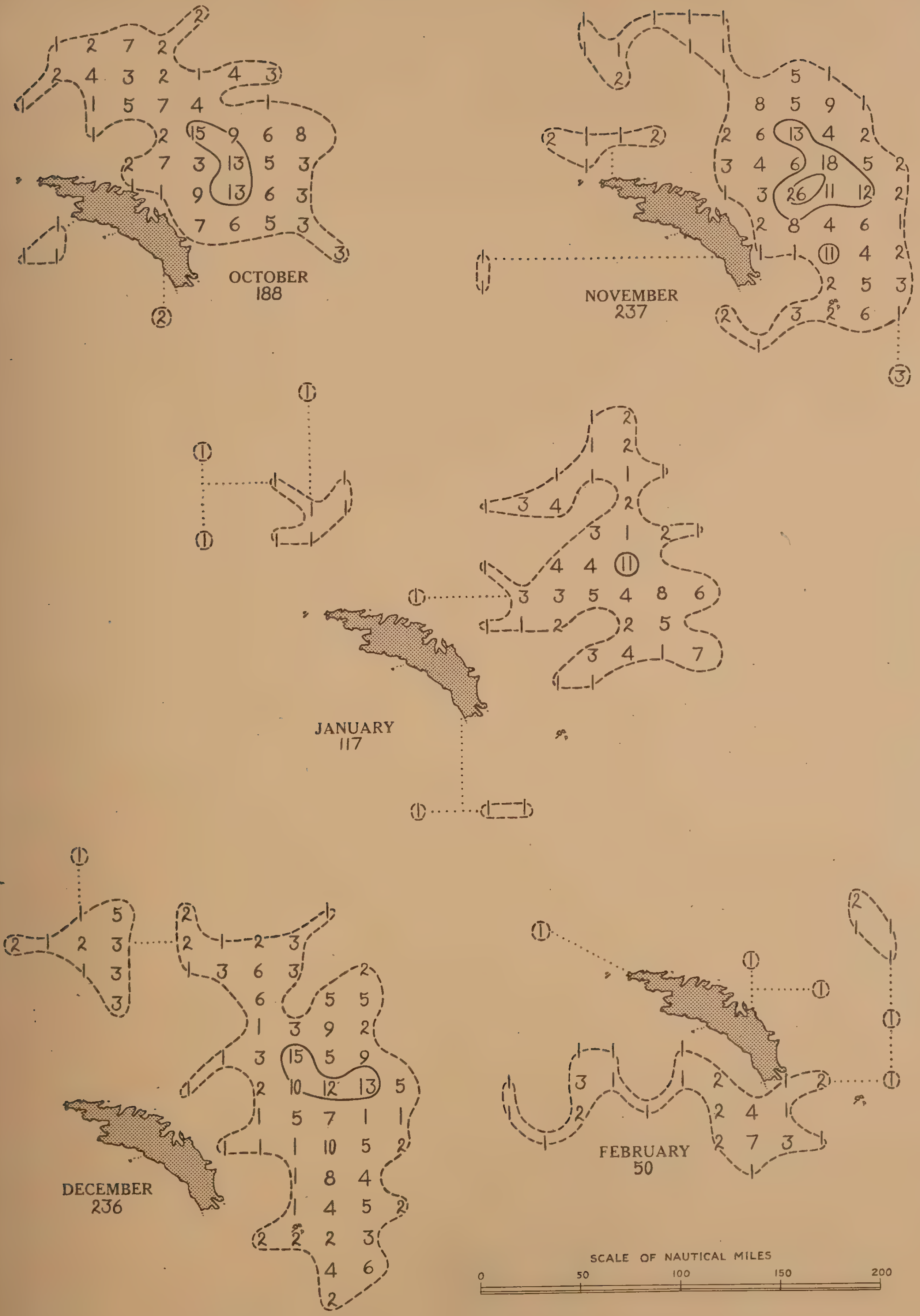
DECEMBER 59

JANUARY 93

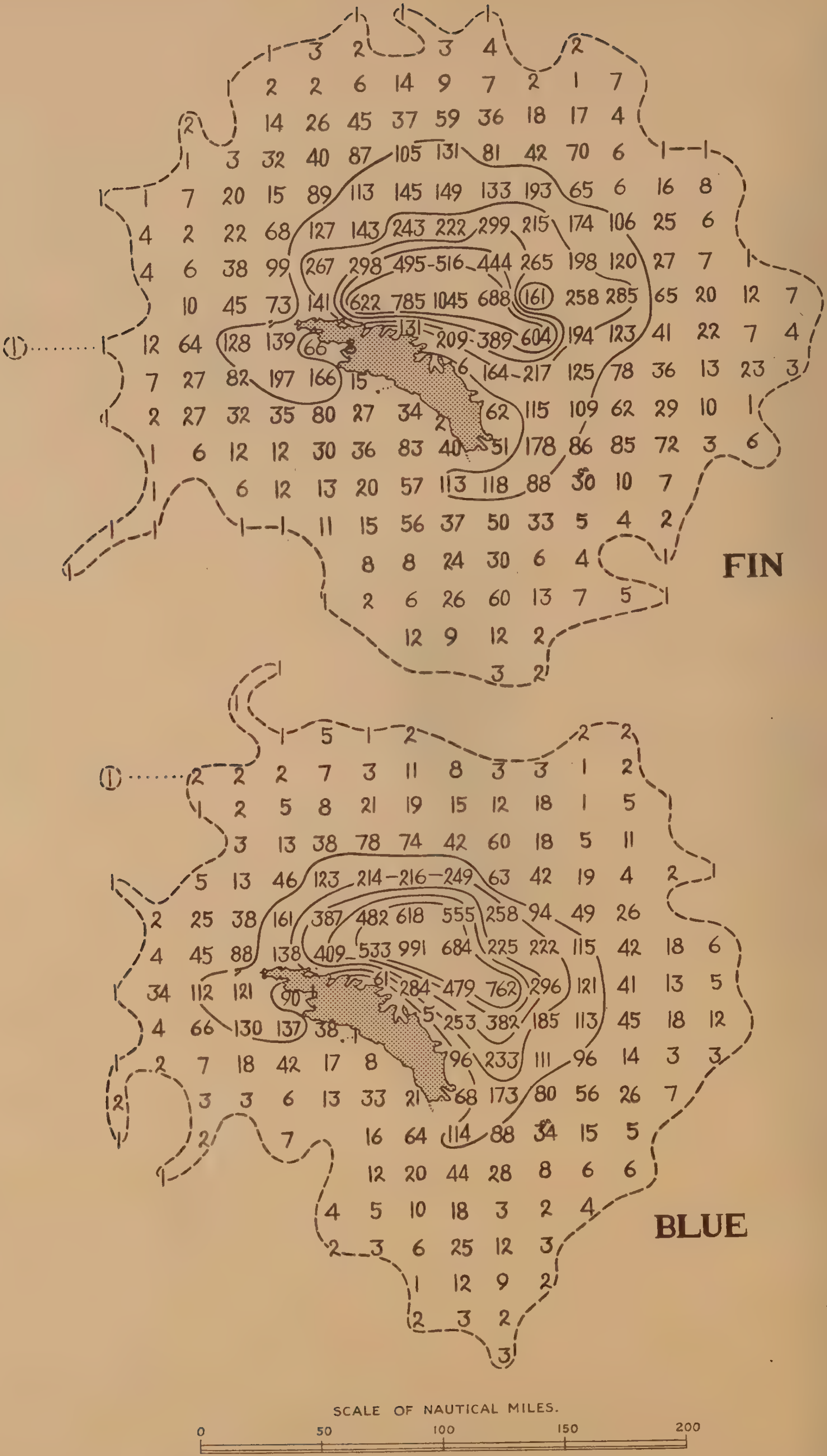
MARCH 32

2
3 5
2 3 2 1
1 1 2
① ① ①
2 1
5 4
① 2 4 5
3 3 3 3 ①
5 1 5 3 2 2 2
5 1 4 10
3 2 1
3 1
2 1
① ①
③
3 2 1 1 2
2 2 1 10 4
2 2 2 1
1 3
1 1
1 2
①
①
2 1
2 8 5
1 1 2 2 6 3 3 6
2 4 2 4 3 8 10 5
1 2 1
①
①
4 1 1 1
3 1 1 2
① 1 3 1
2
①
SCALE OF NAUTICAL MILES.
0
50
100
150
200

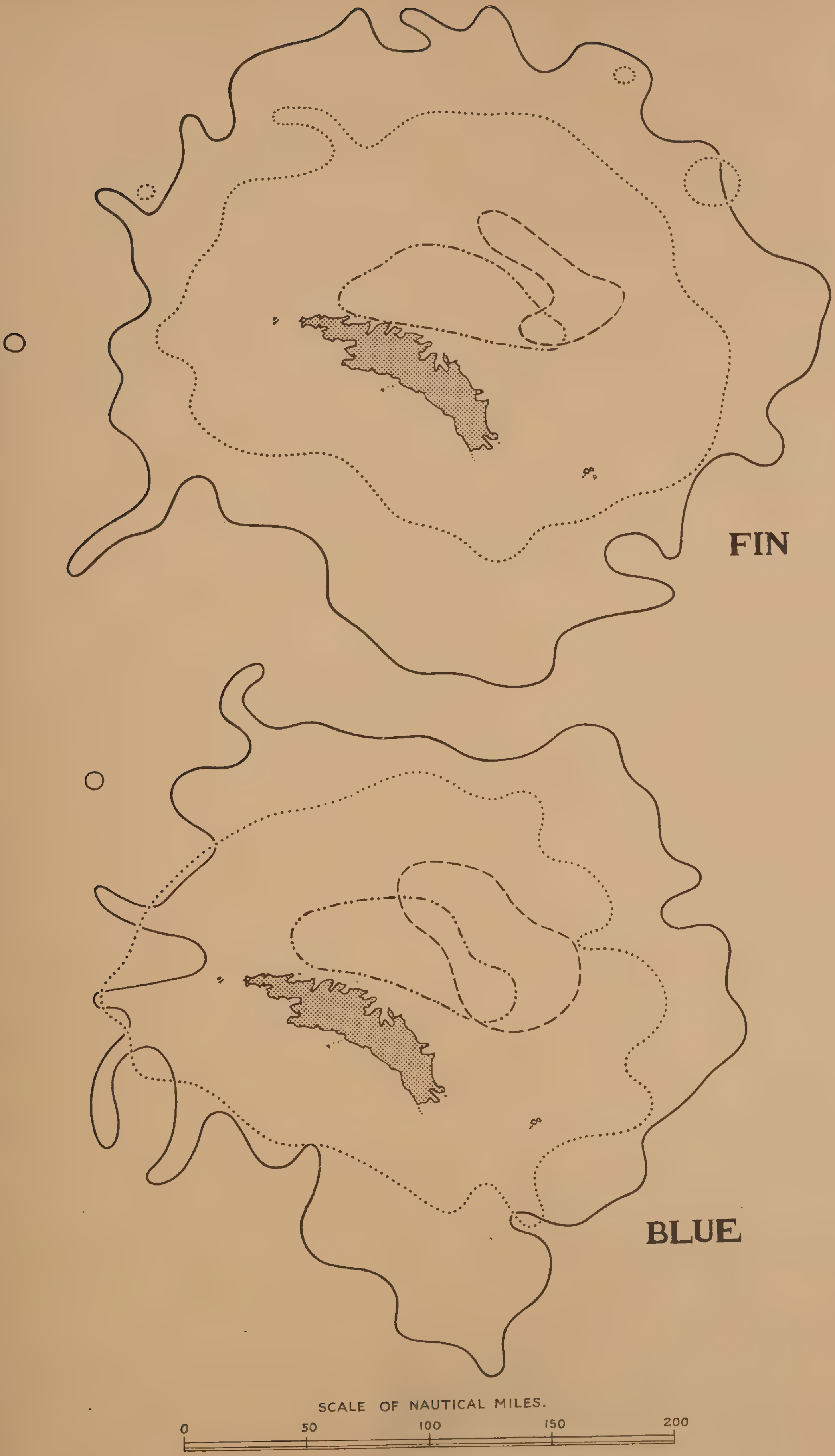
Distribution of Blue whales taken on the South Georgia grounds in season 1929–30


OCTOBER
188
NOVEMBER
237
JANUARY
117
DECEMBER
236
FEBRUARY
50
SCALE OF NAUTICAL MILES
0
50
100
150
200

Distribution of Blue whales taken on the South Georgia grounds in season 1930–1


FIN
BLUE
SCALE OF NAUTICAL MILES.
0
50
100
150
200

Distribution of Fin and Blue whales on the South Georgia grounds: based on all recorded positions of capture during the eight seasons 1923–4 to 1930–1


FIN
BLUE
SCALE OF NAUTICAL MILES.
0
50
100
150
200

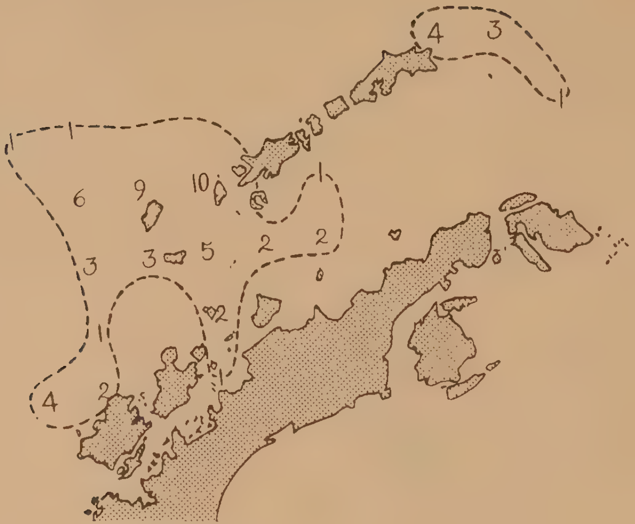
Charts showing the recent extension of the South Georgia whaling grounds

········ limits of whaling area during seasons 1923–4 to 1926–7

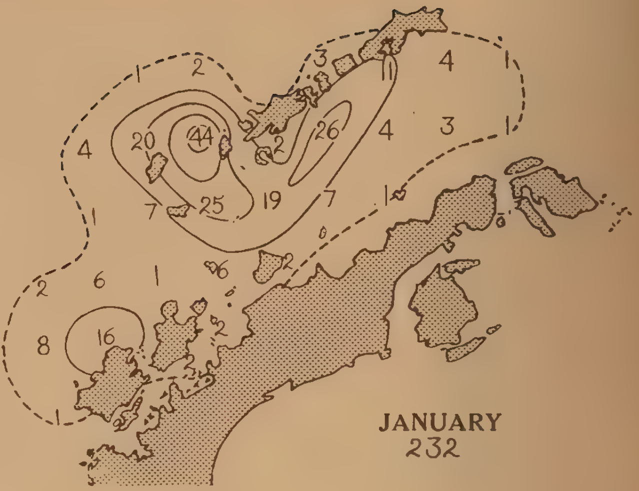
——— ,, ,, ,, ,, ,, 1927–8 to 1930–1

—·—·· main concentration (300 contour) during seasons 1923–4 to 1926–7

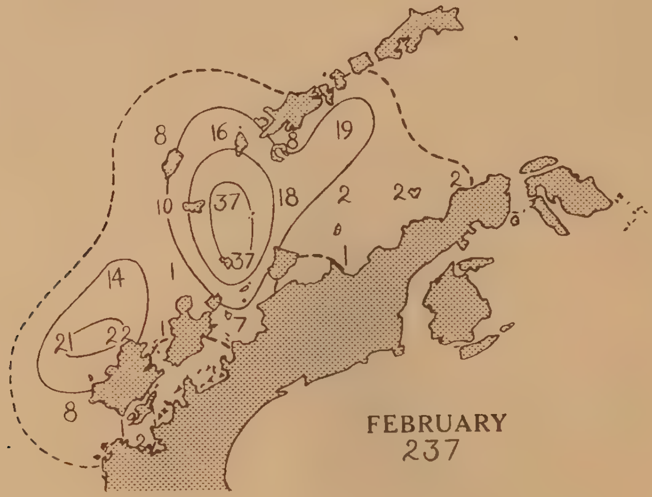
— — — ,, ,, (150 contour) ,, ,, 1927–8 to 1930–1


4
3
1
1
6
9
10
1
3
3
5
2
2
2
1
1
4
2

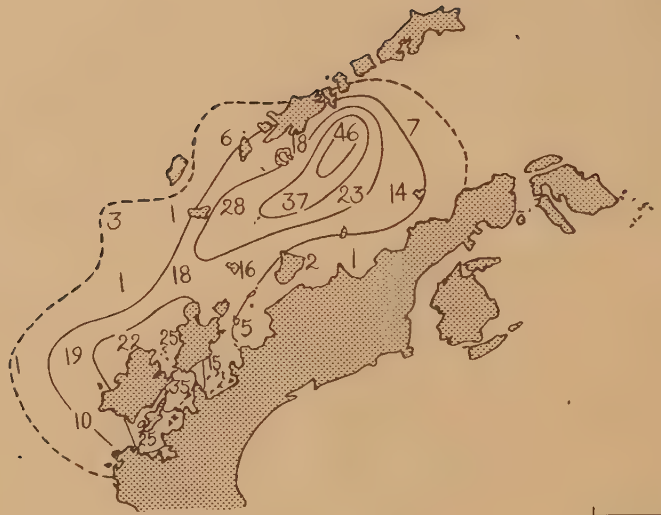
DECEMBER
61


3
11
4
1
2
1
4
20
44
26
4
3
2
1
7
25
19
7
1
2
6
1
6
2
8
16
2
3
1

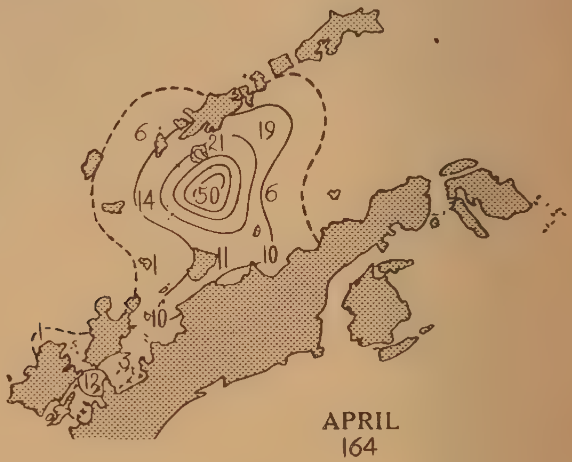
JANUARY
232


8
16
19
10
37
18
2
2
2
37
1
14
1
21
22
7
1
8
2

FEBRUARY
237


6
8
46
7
3
1
28
37
23
14
18
6
2
1
1
5
19
22
25
15
35
10
25
1

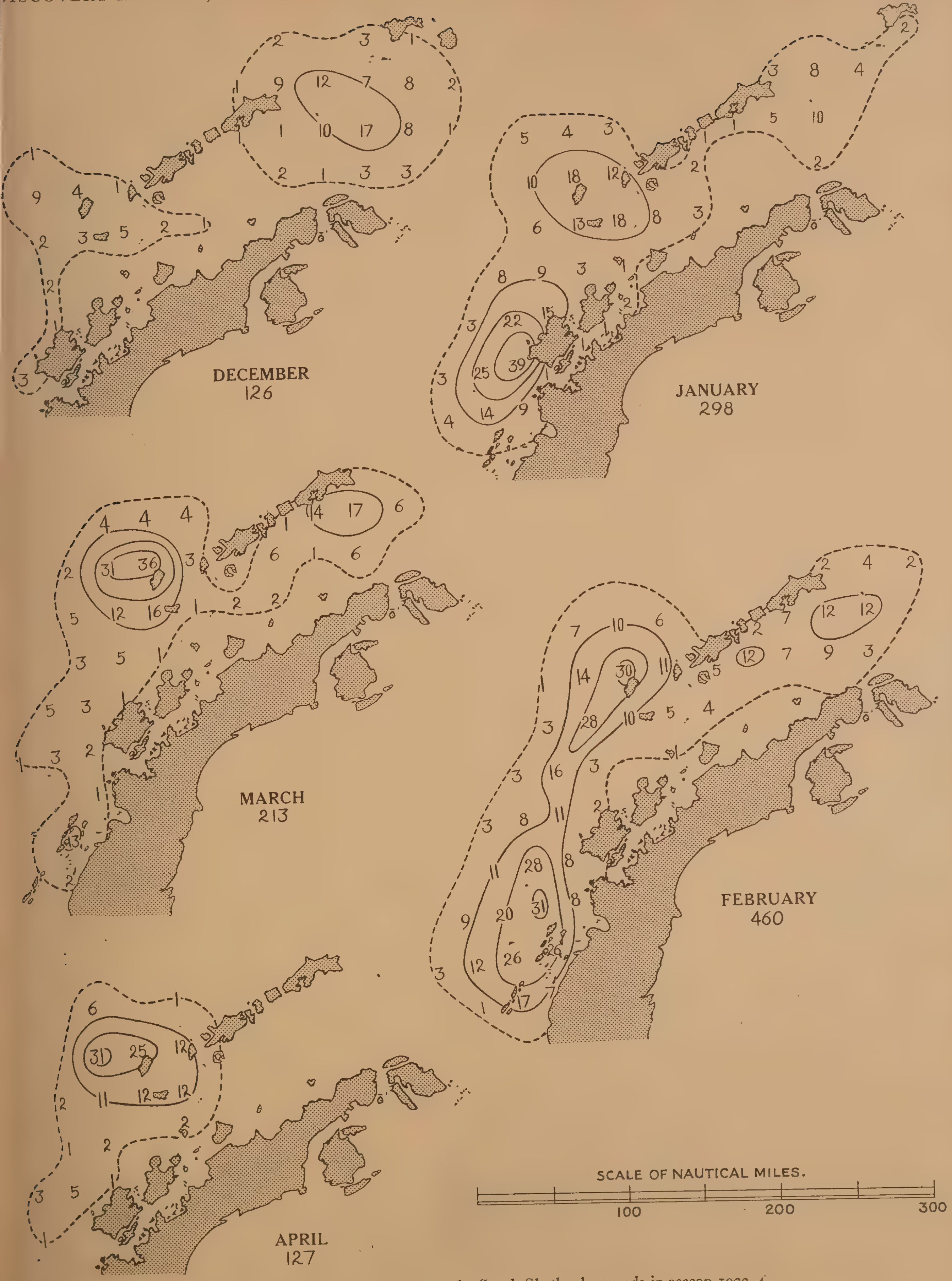
MARCH
378


6
21
19
14
50
6
1
11
10
10
1
3
12

APRIL
164

SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Fin whales taken on the South Shetland grounds in season 1922–3



DECEMBER
126

JANUARY
298

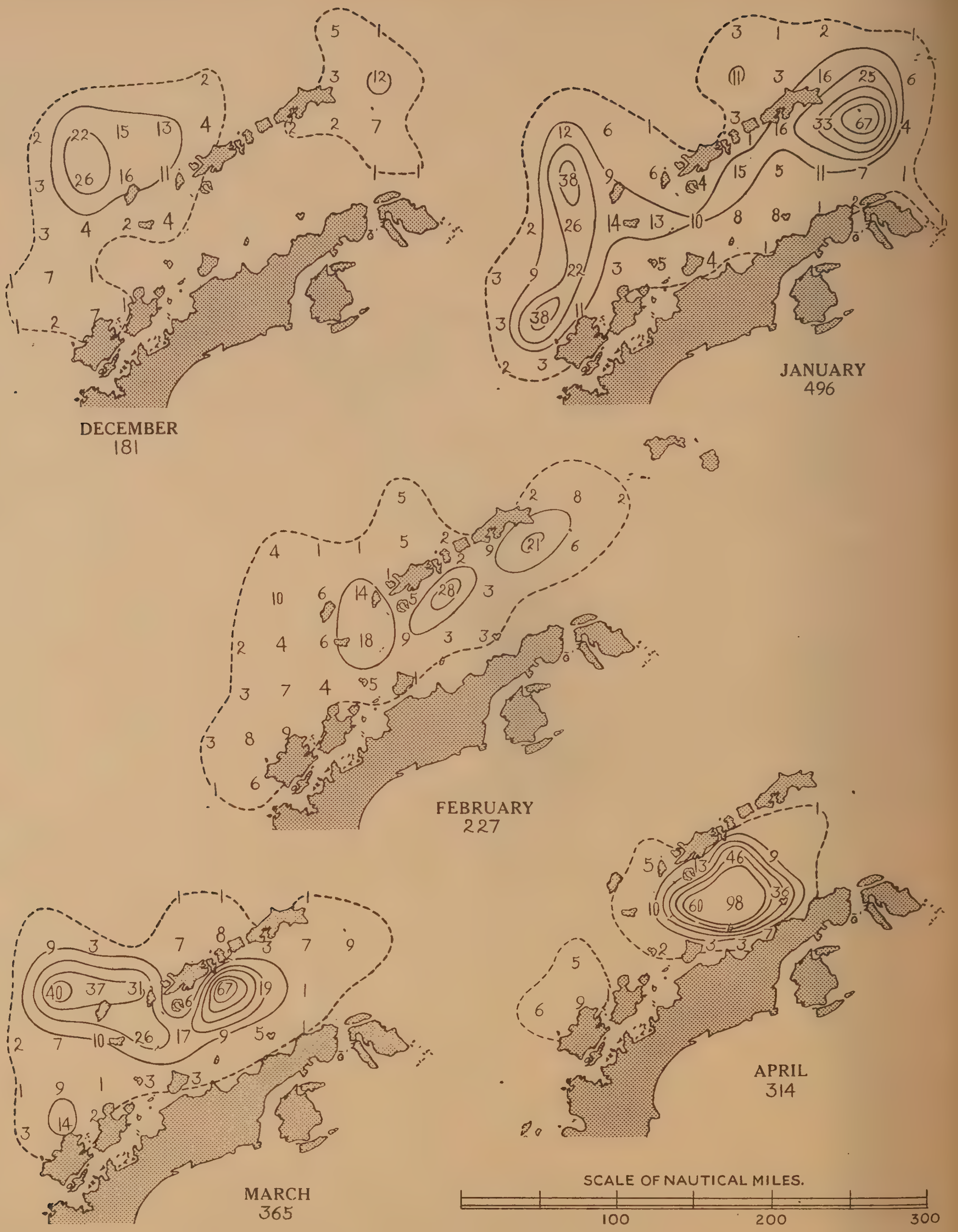
MARCH
213

FEBRUARY
460

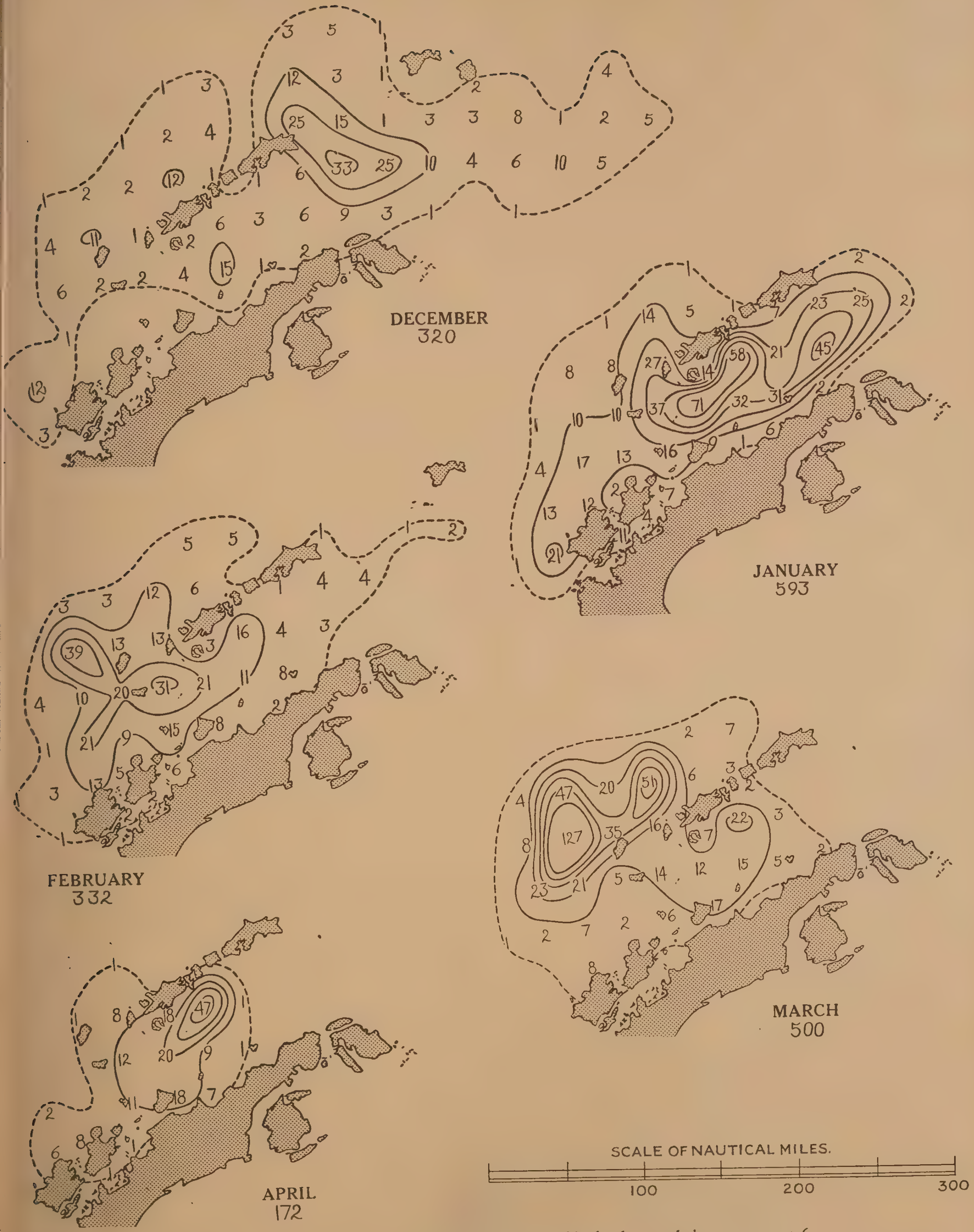
APRIL
127

SCALE OF NAUTICAL MILES.
100
200
300

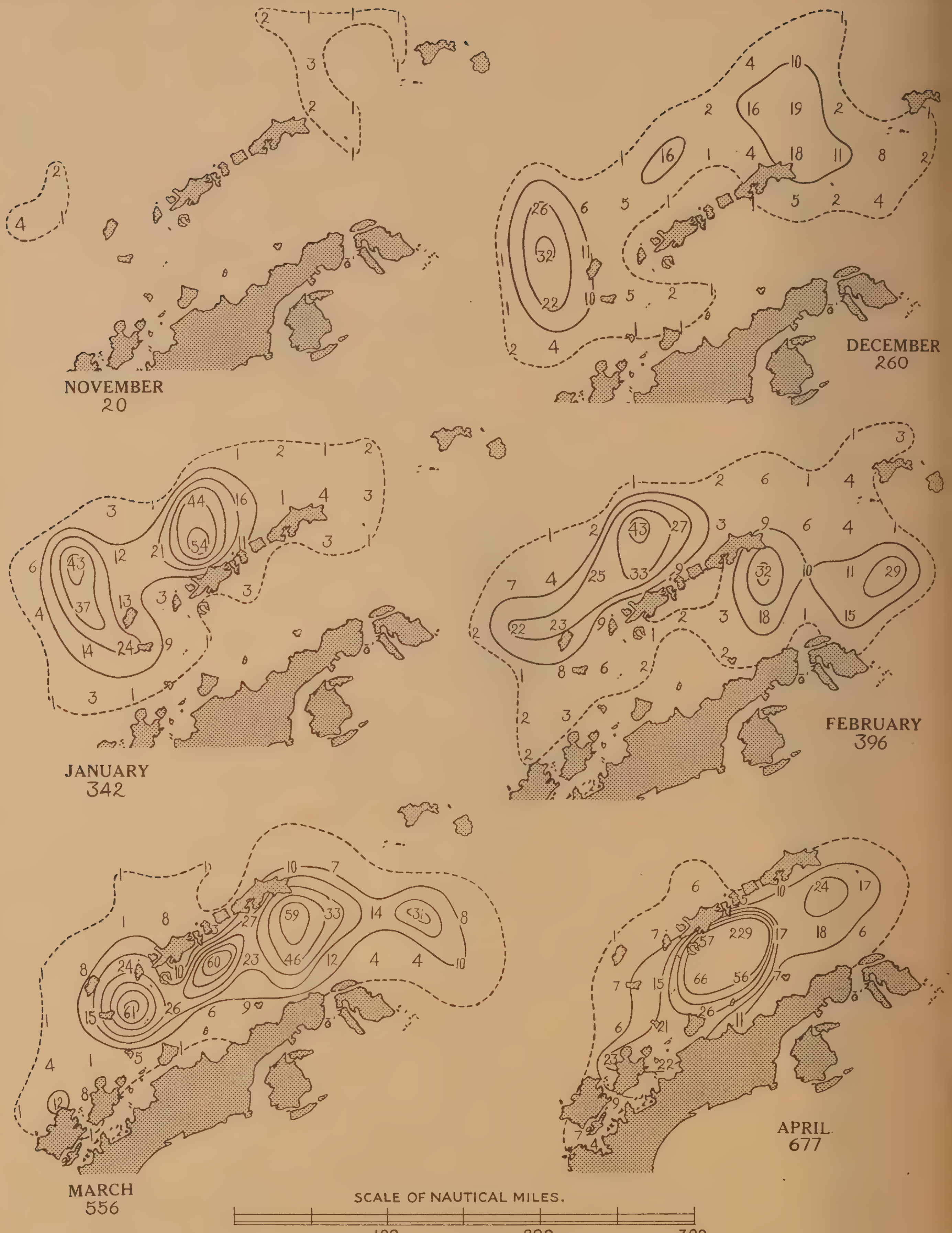
Distribution of Fin whales taken on the South Shetland grounds in season 1923–4


DECEMBER
181
JANUARY
496
FEBRUARY
227
MARCH
365
APRIL
314
SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Fin whales taken on the South Shetland grounds in season 1924–5


DECEMBER
320
JANUARY
593
FEBRUARY
332
MARCH
500
APRIL
172
SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Fin whales taken on the South Shetland grounds in season 1925–6



NOVEMBER
20

DECEMBER
260

JANUARY
342

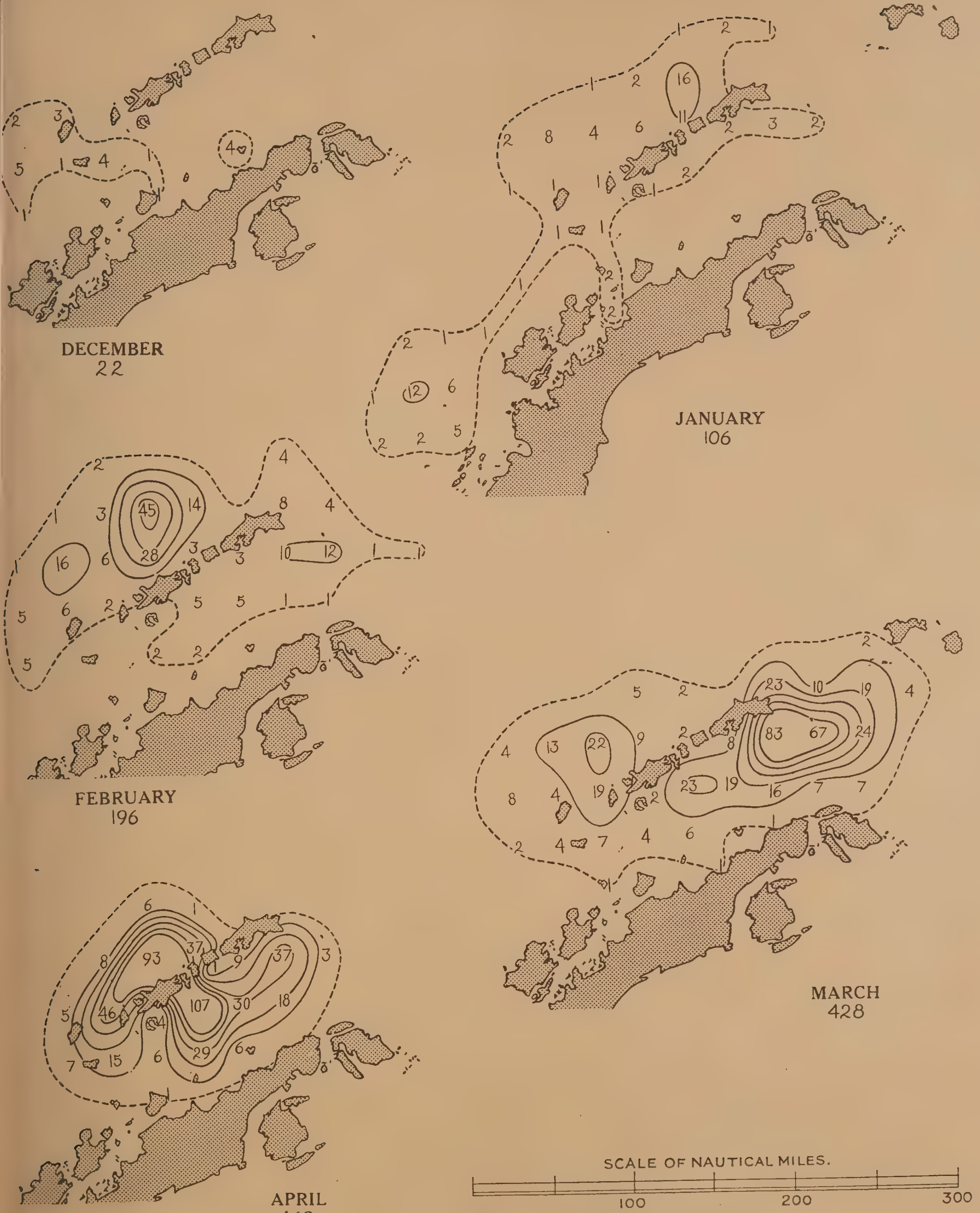
FEBRUARY
396

MARCH
556

APRIL
677

SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Fin whales taken on the South Shetland grounds in season 1926–7



DECEMBER 22

JANUARY 106

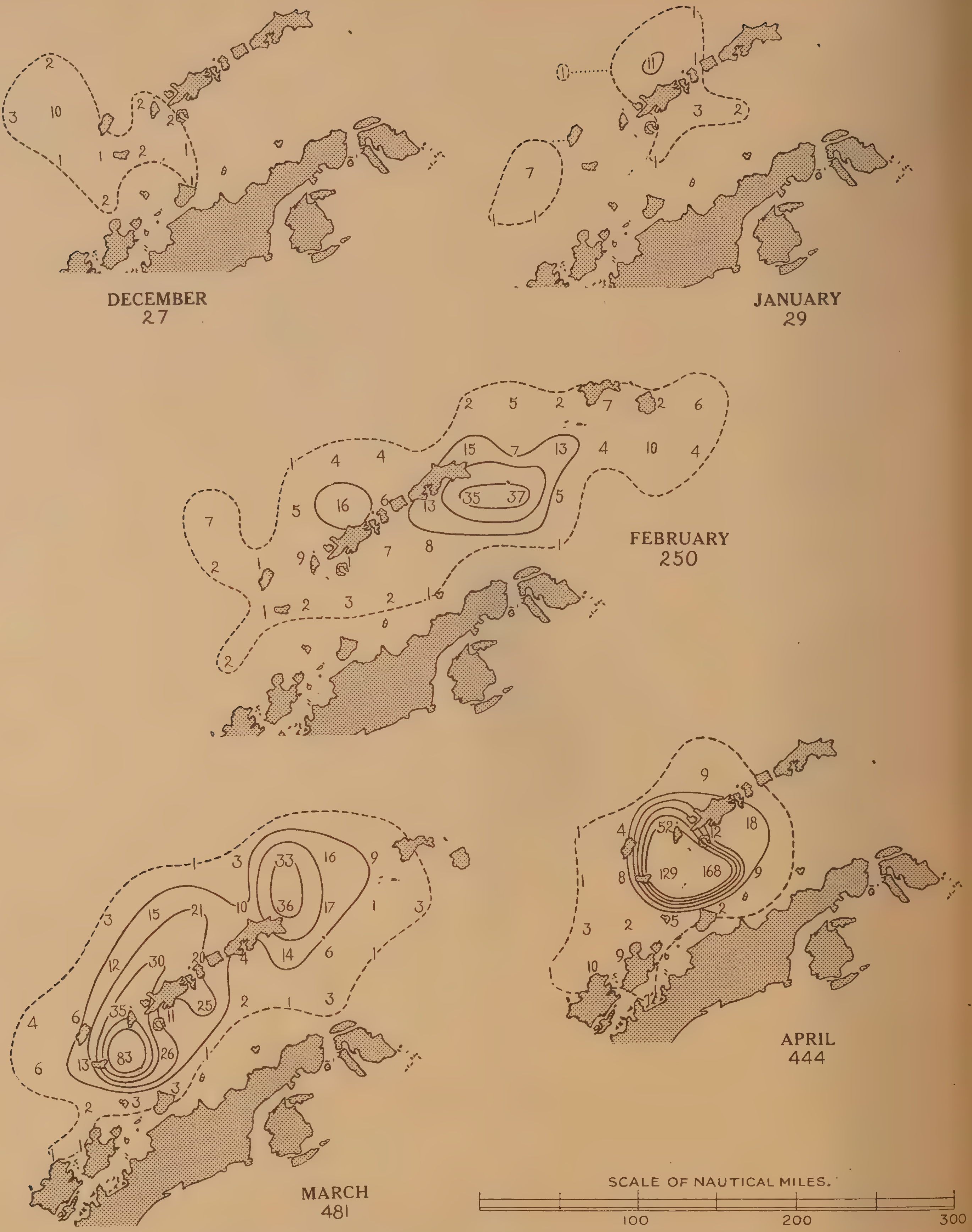
FEBRUARY 196

MARCH 428

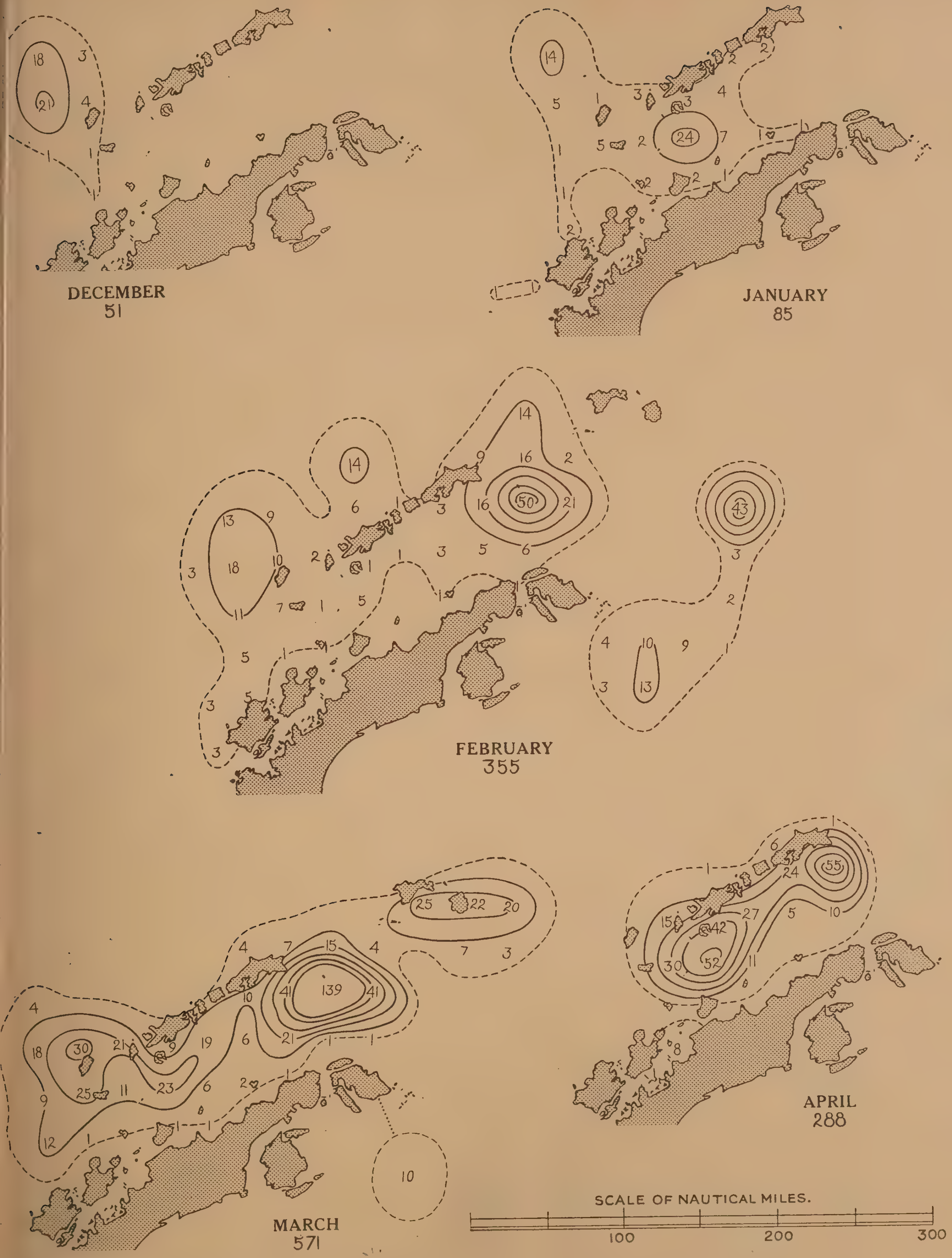
APRIL 469

SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Fin whales taken on the South Shetland grounds in season 1927–8


DECEMBER
27
JANUARY
29
FEBRUARY
250
MARCH
481
APRIL
444
SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Fin whales taken on the South Shetland grounds in season 1928–9



SCALE OF NAUTICAL MILES.
100
200
300

DECEMBER
51

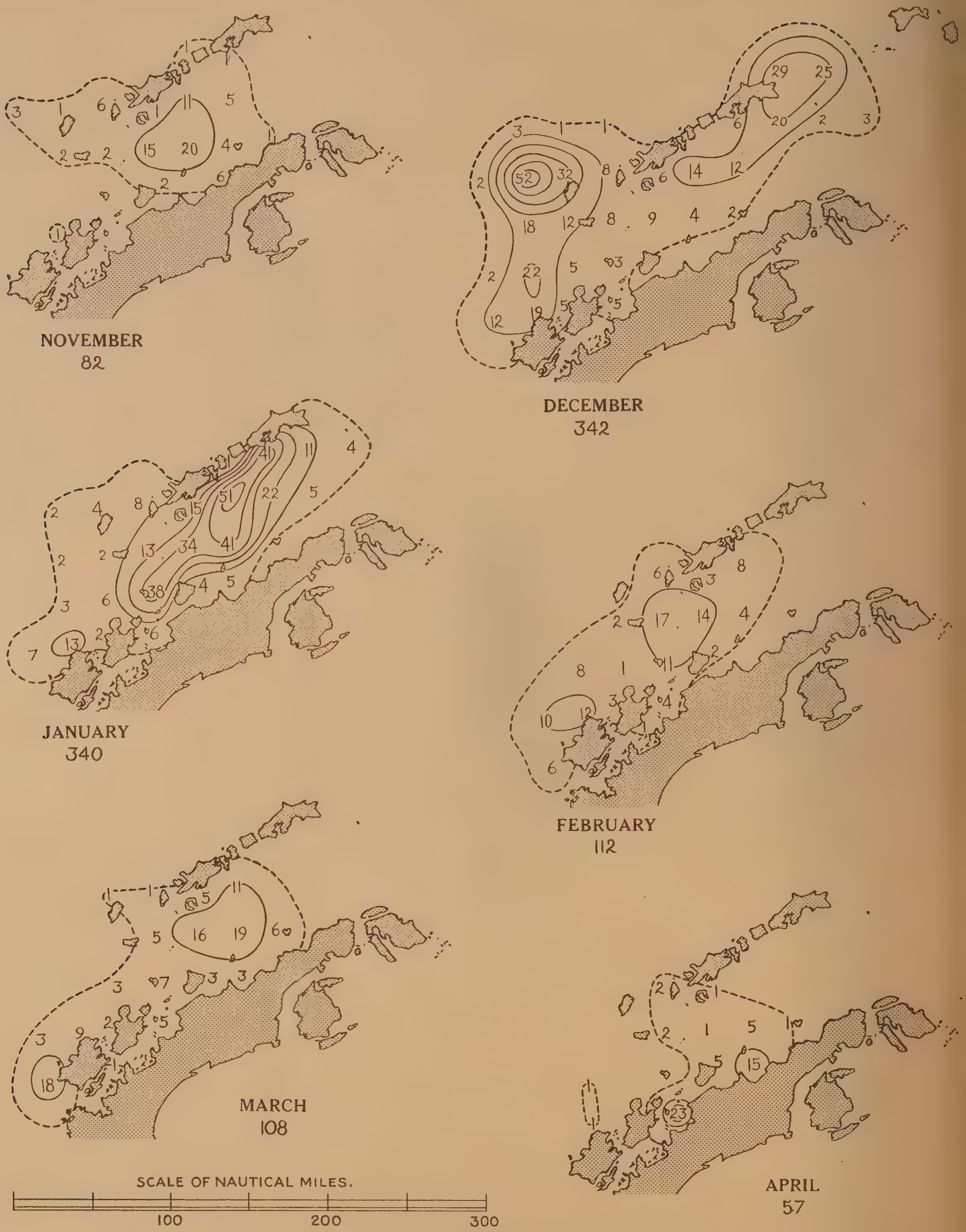
JANUARY
85

FEBRUARY
355

MARCH
571

APRIL
288

Distribution of Fin whales taken on the South Shetland grounds in season 1929–30



NOVEMBER
82

DECEMBER
342

JANUARY
340

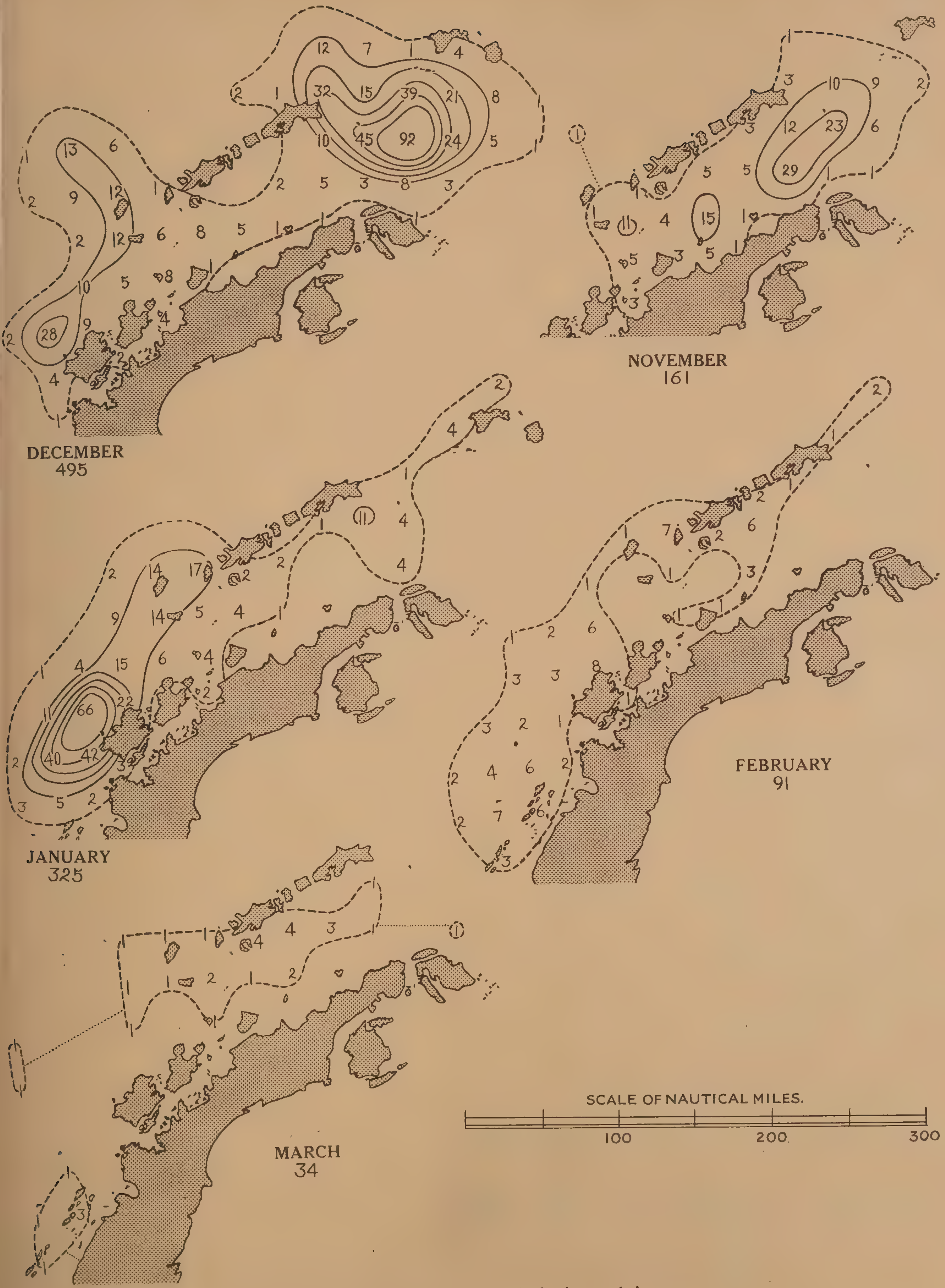
FEBRUARY
112

MARCH
108

APRIL
57

SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Blue whales on the South Shetland grounds in season 1922–3



DECEMBER
495

NOVEMBER
161

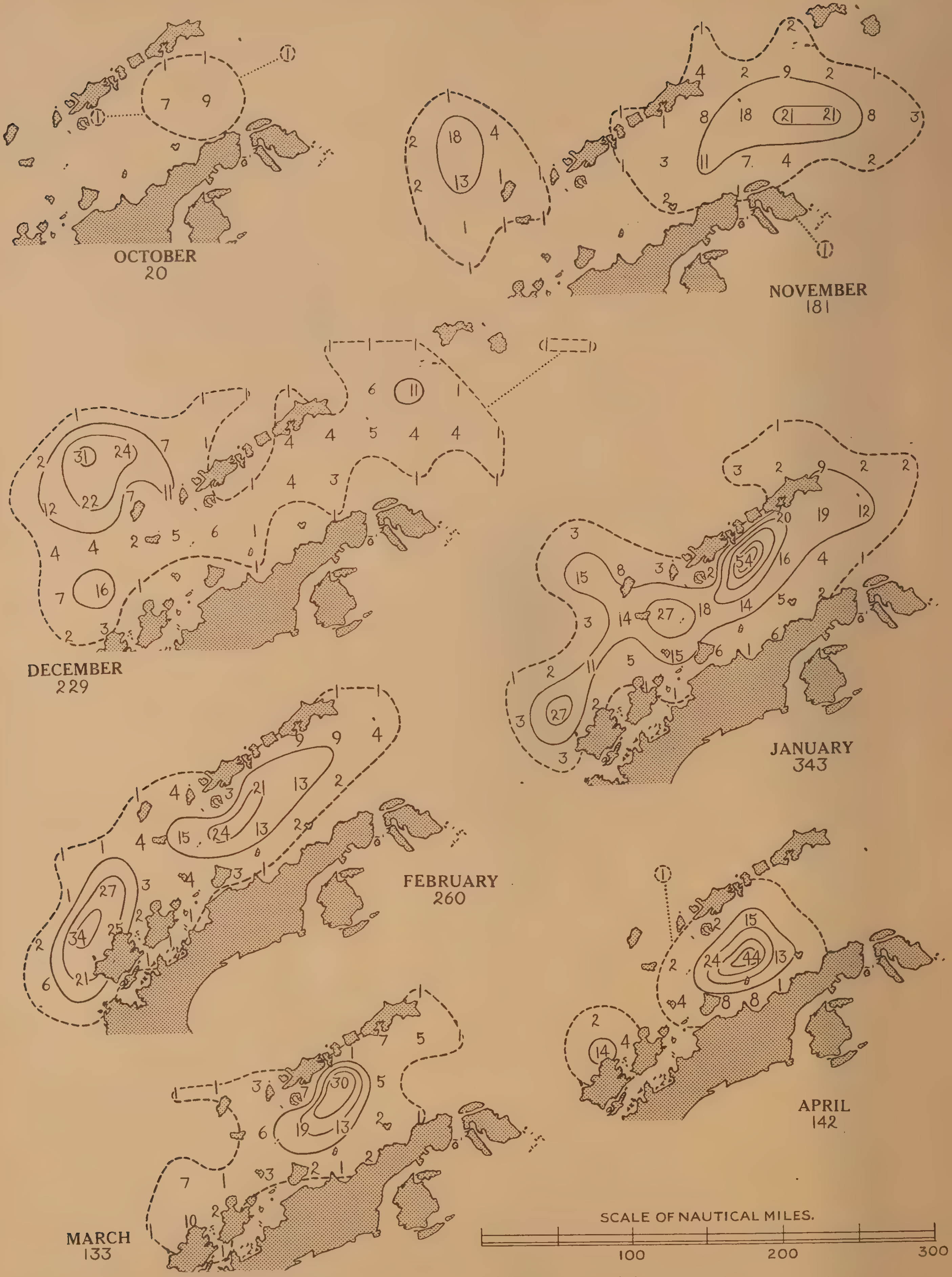
JANUARY
325

FEBRUARY
91

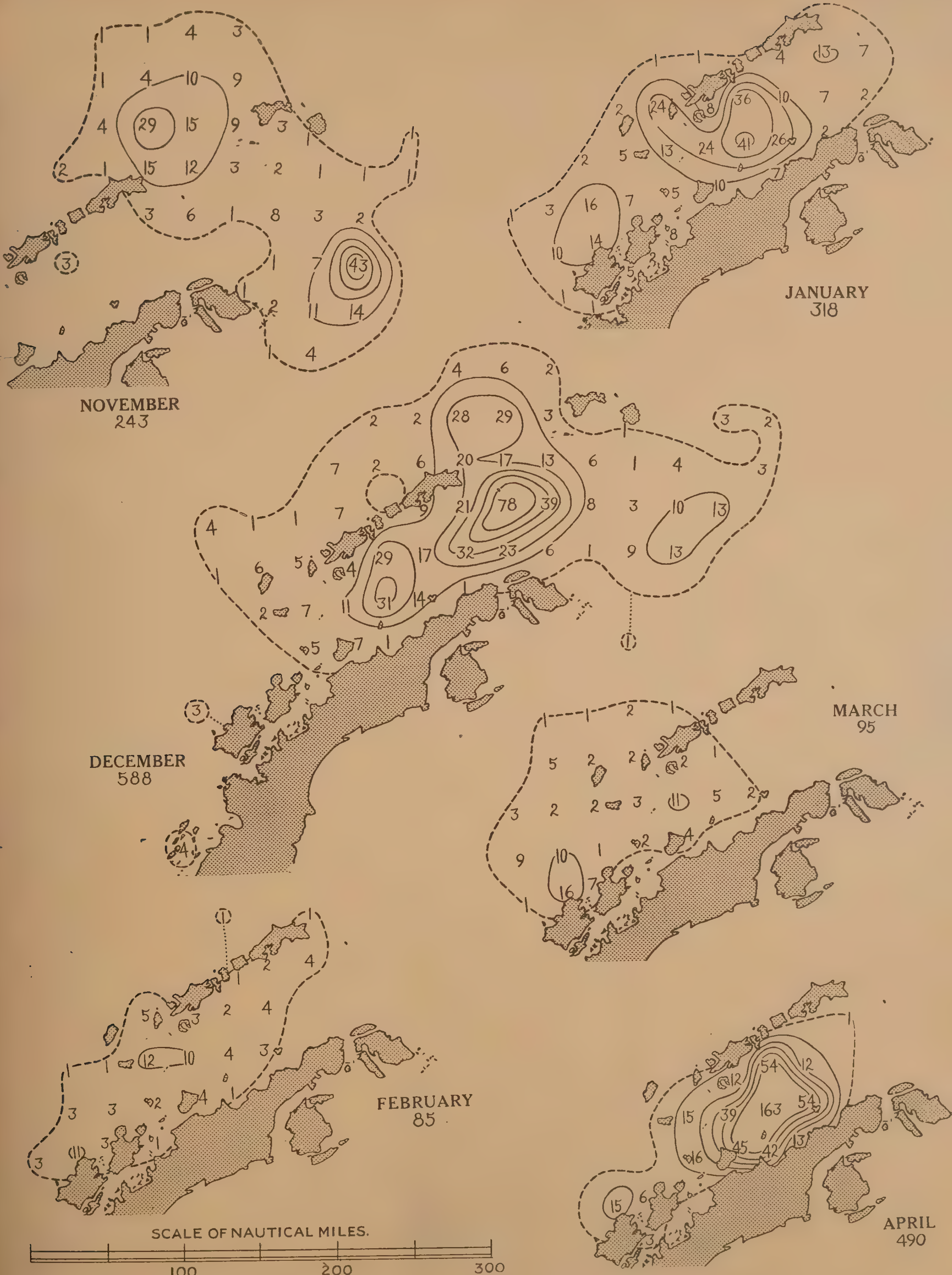
MARCH
34

SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Blue whales on the South Shetland grounds in season 1923–4


OCTOBER
20
NOVEMBER
181
DECEMBER
229
JANUARY
343
FEBRUARY
260
MARCH
133
APRIL
142
SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Blue whales on the South Shetland grounds in season 1924–5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3
6
1
8
3
2
3
1
7
43
2
11
14
4
NOVEMBER
243
4
13
7
2
24
8
36
10
7
2
5
13
24
41
26
2
2
5
10
7
3
16
7
8
14
10
5
3
1
JANUARY
318
4
6
2
2
2
28
29
3
3
2
7
2
6
20
17
13
6
1
4
3
4
1
1
7
9
21
78
39
8
3
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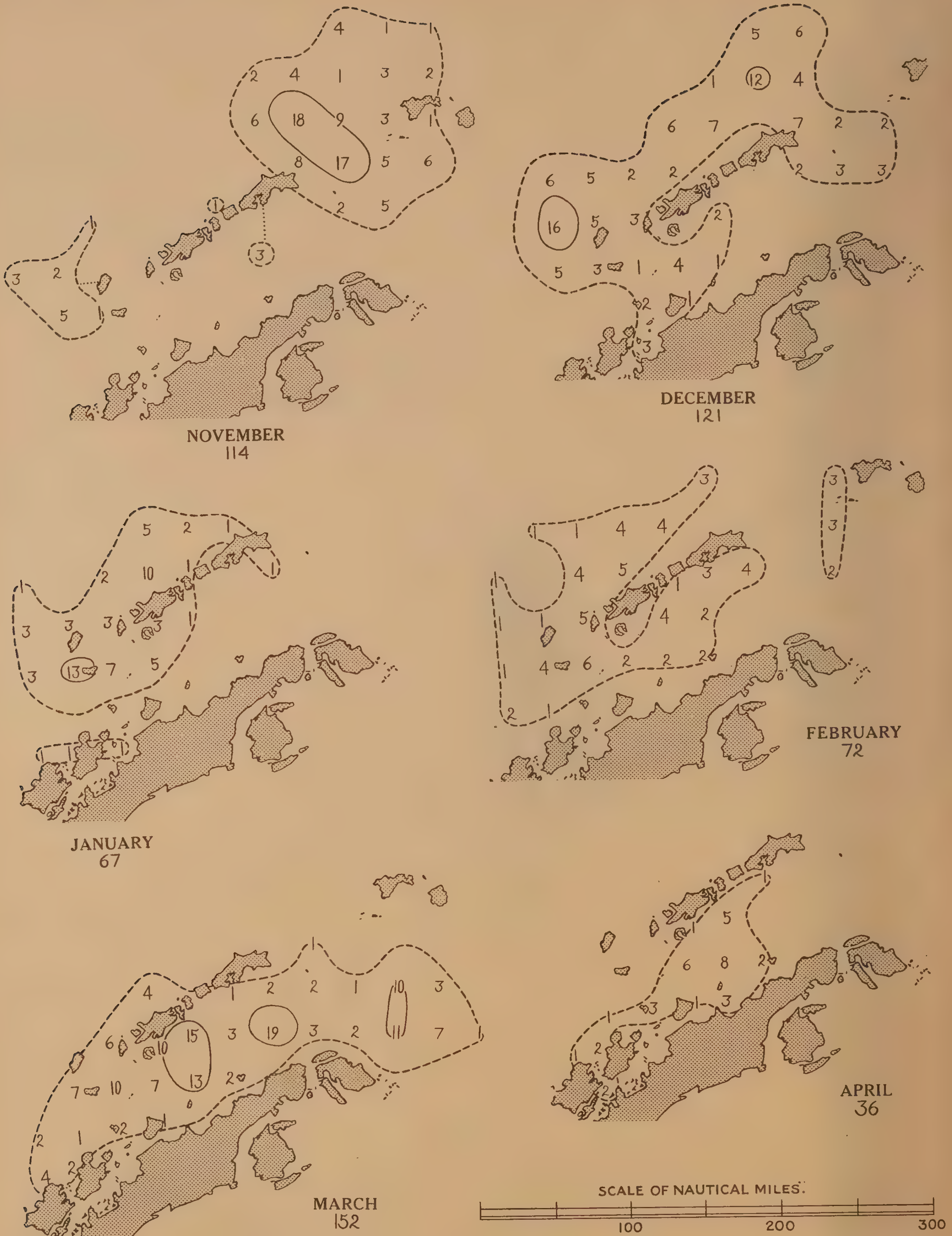
13
6
5
4
29
17
32
23
6
1
9
13
2
7
11
31
14
1
5
7
1
1
3
4
DECEMBER
588
2
1
5
2
2
2
1
3
2
2
3
11
5
2
9
10
1
2
4
16
7
1
MARCH
95
1
2
4
1
5
3
2
4
1
12
10
4
3
3
3
2
4
1
3
11
1
3
FEBRUARY
85
1
54
12
12
15
39
163
54
16
45
42
13
15
6
3
APRIL
490
SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Blue whales on the South Shetland grounds in season 1925–6



NOVEMBER
114

DECEMBER
121

JANUARY
67

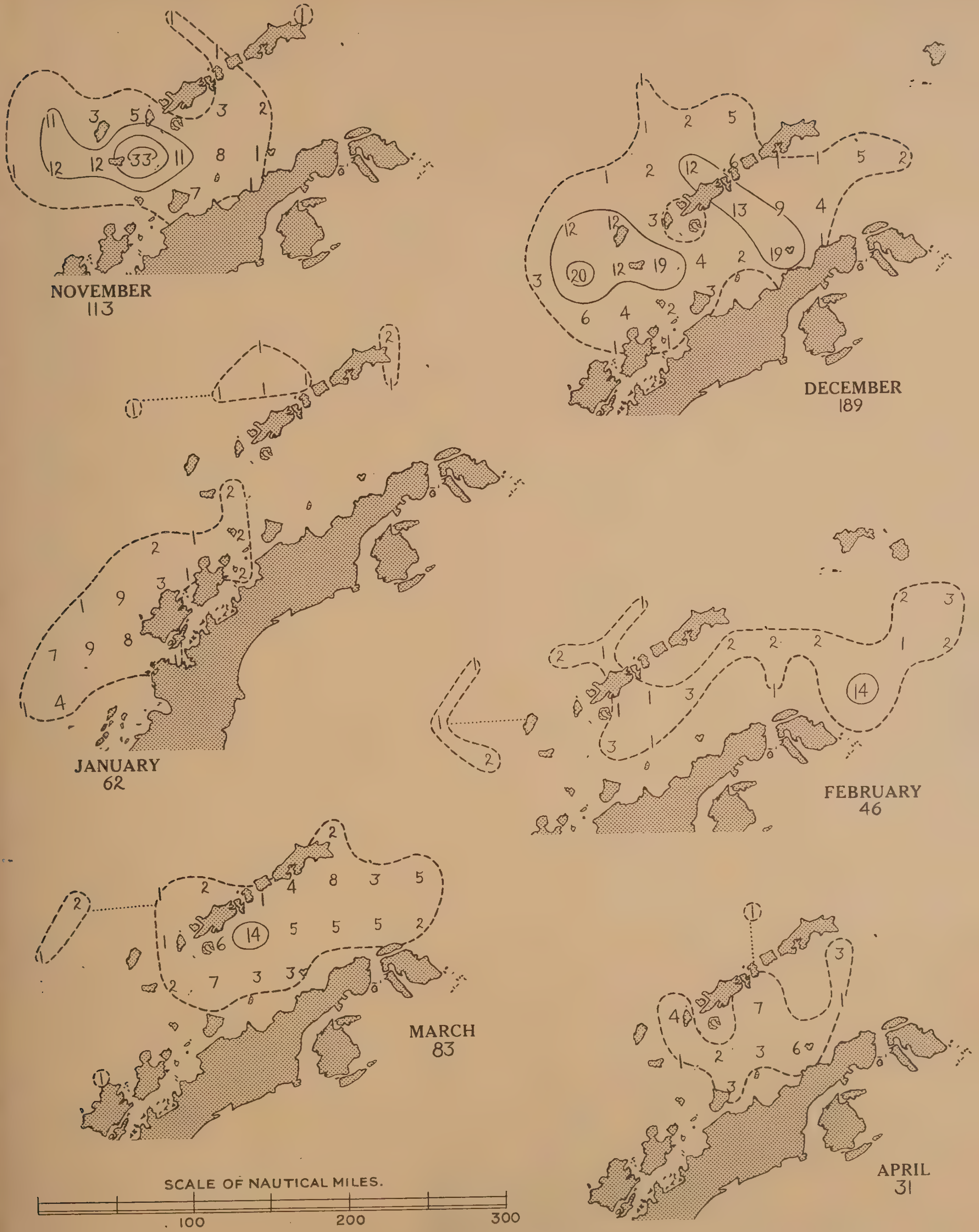
FEBRUARY
72

MARCH
152

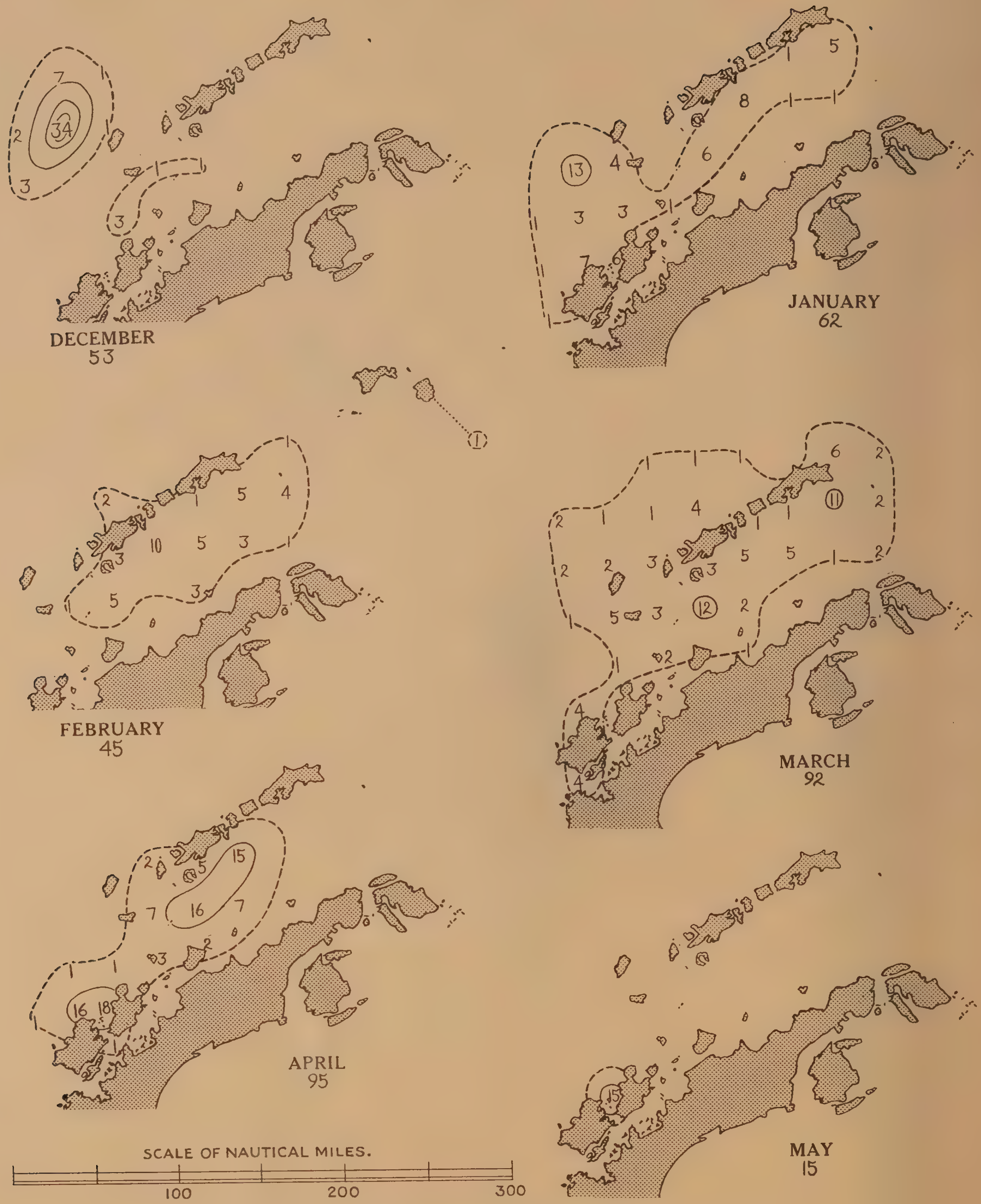
APRIL
36

SCALE OF NAUTICAL MILES.
100
200
300

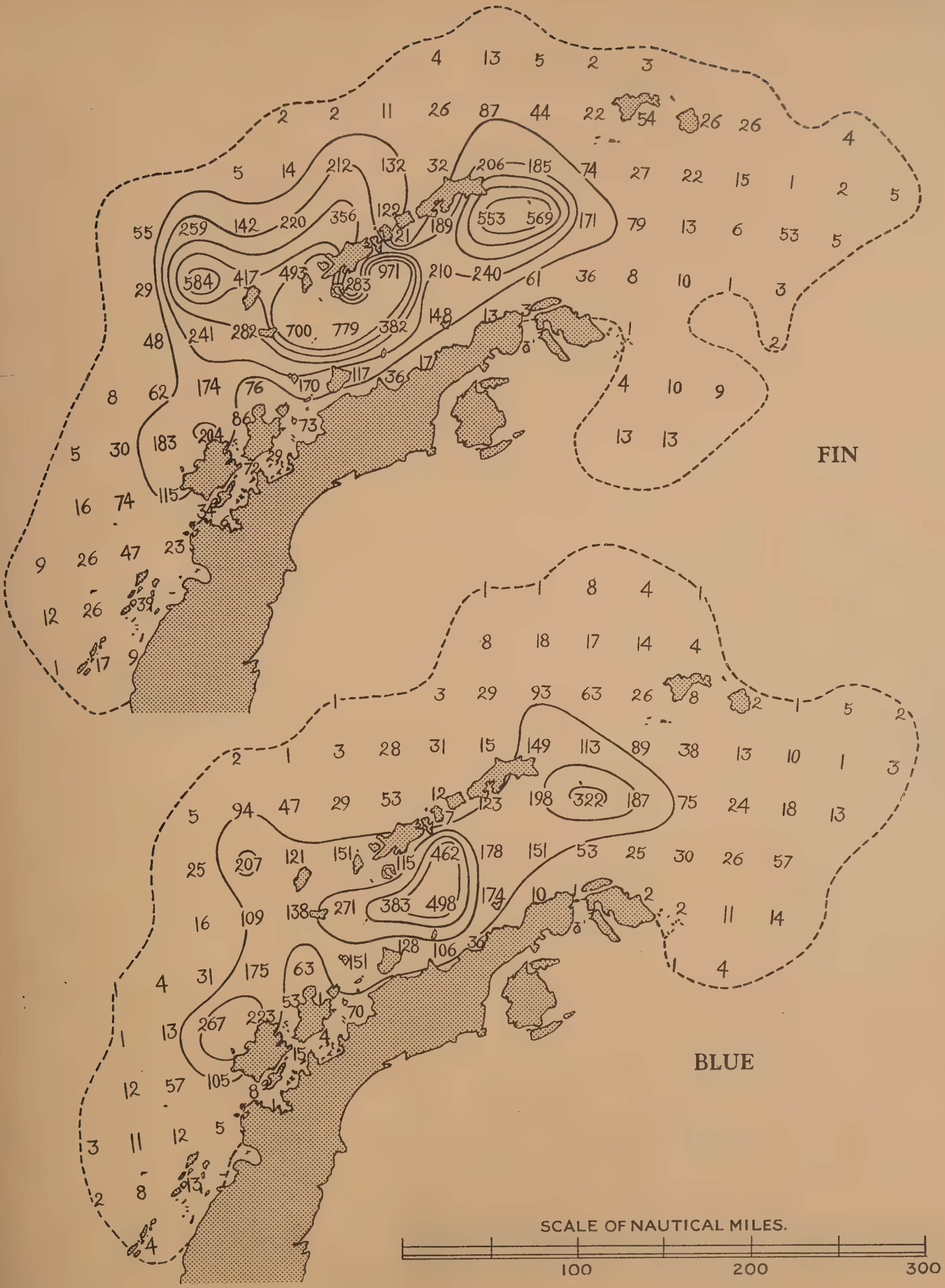
Distribution of Blue whales on the South Shetland grounds in season 1926–7


NOVEMBER
113
DECEMBER
189
JANUARY
62
FEBRUARY
46
MARCH
83
APRIL
31
SCALE OF NAUTICAL MILES.
100
200
300

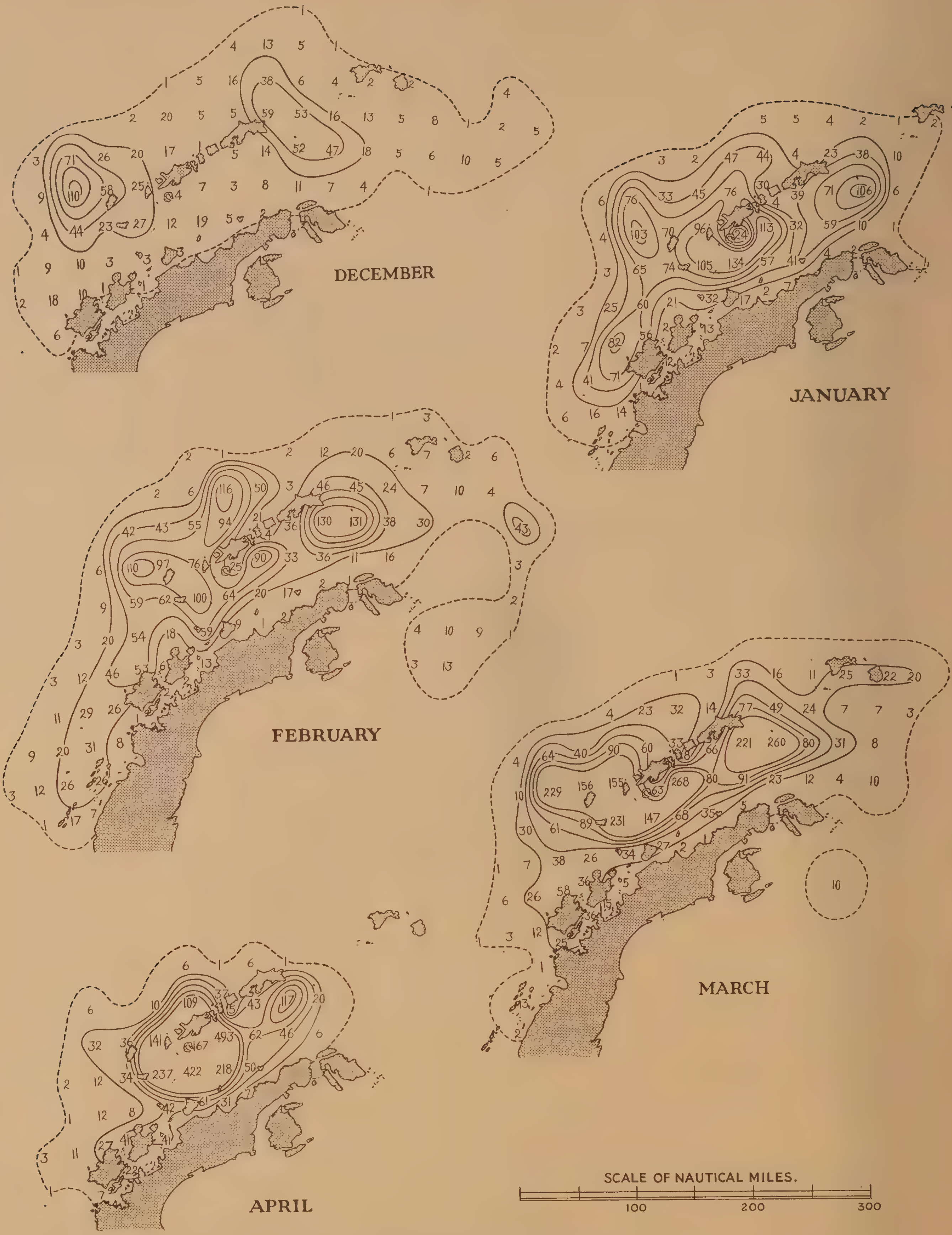
Distribution of Blue whales on the South Shetland grounds in season 1927–8


DECEMBER
53
JANUARY
62
FEBRUARY
45
MARCH
92
APRIL
95
MAY
15
SCALE OF NAUTICAL MILES.
100
200
300

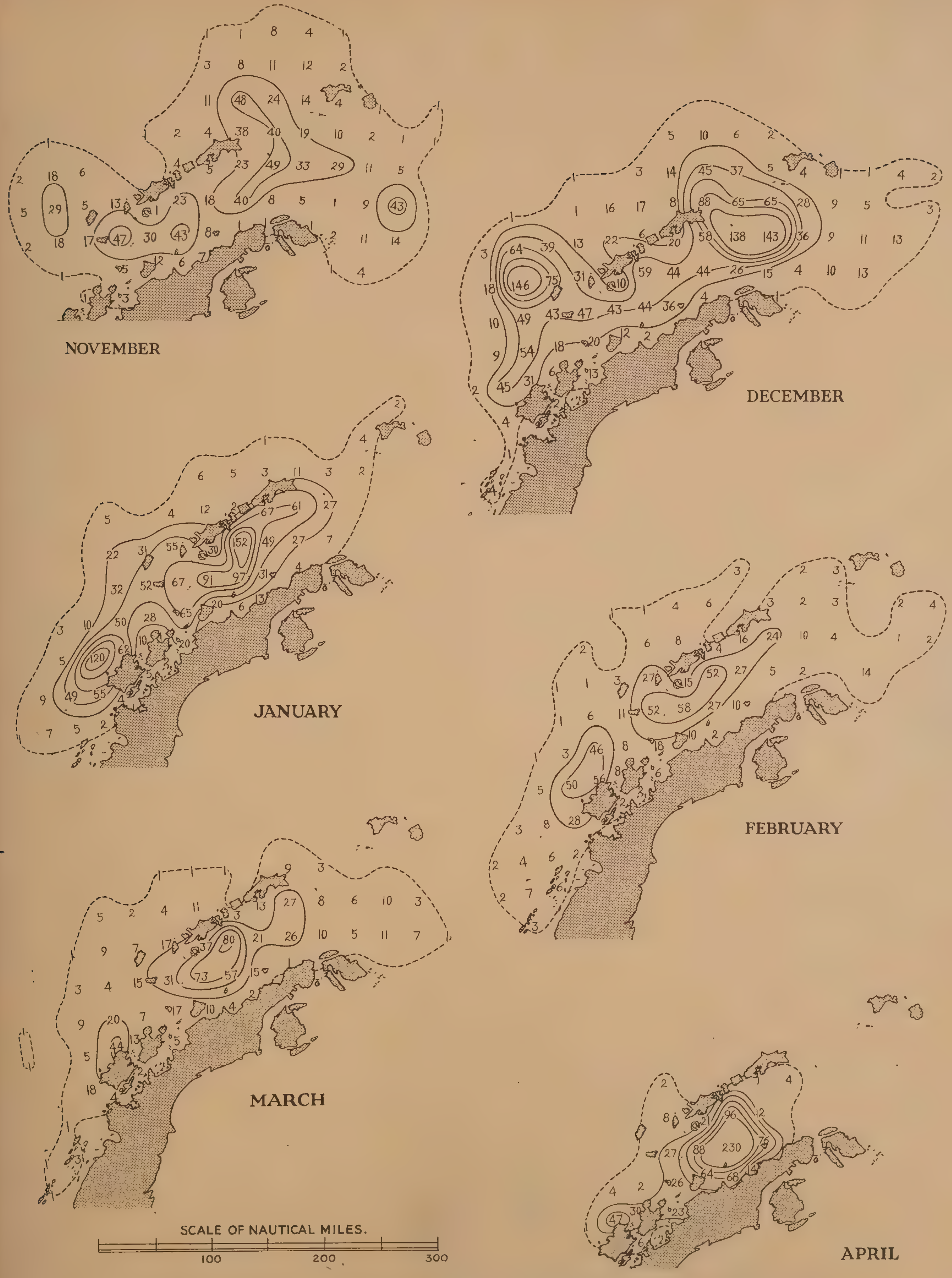
Distribution of Blue whales on the South Shetland grounds in season 1928–9


FIN
BLUE
SCALE OF NAUTICAL MILES.
100
200
300

Distribution of Fin and Blue whales on the South Shetland grounds: based on all recorded positions of capture during the eight seasons 1922–3 to 1929–30


DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
SCALE OF NAUTICAL MILES.
100
200
300

Monthly distribution of Fin whales on the South Shetland grounds: based on monthly totals for the eight seasons 1922–3 to 1929–30


NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
SCALE OF NAUTICAL MILES.
100
200
300

Monthly distribution of Blue whales on the South Shetland grounds: based on monthly totals for the seven seasons 1922–3 to 1928–9

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PACIFIC OCEANIC FISHERY
INVESTIGATIONS

ON THE DEVELOPMENT OF *CEPHALODISCUS*

By

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ON THE DEVELOPMENT OF *CEPHALODISCUS*

By C. C. John, M.A., D.Sc., D.I.C.

(Plates XLIII, XLIV)

INTRODUCTION

THE observations which have hitherto been made on the development of *Cephalodiscus* are mostly of a fragmentary nature owing to the difficulty of obtaining the eggs and larvae. From the material procured by the Challenger expedition, Masterman (1900) recorded a few segmenting eggs. Andersson (1903), in a preliminary note, showed that the segmented embryos left the parent colony in the form of ciliated planulae. Harmer (1905) observed that the eggs were heavily laden with yolk, that their segmentation was holoblastic and nearly equal, and suggested that they might give rise to solid embryos in which the endoderm arises by delamination. Further, he showed that the five body cavities of the adult arose at an early stage in development. Andersson (1907), in his account of *Cephalodiscus* collected by the Swedish South Polar Expedition, described a few more stages. He stated that there was a gastrula-like stage, in which there is a centrally placed mass of yolk with a narrow lumen. He believed that this central mass of yolk represented the endoderm, which originated by a process of invagination. He also confirmed the observations of Harmer regarding the early appearance of the body cavities. Schepotieff (1909) also described a few stages, but his account added nothing to the elucidation of the gastrula stage described by Andersson. He confirmed the existence of the planula-like larva, and described a later stage which was also free-swimming and in which the five body cavities were visible. He regarded the central mass of yolk in the embryo and the larva as representing the endoderm formed by invagination. The account of Braem (1911) does not add anything further to our knowledge of the development of the group, but he drew attention to the resemblance between the free-swimming larva of *Cephalodiscus* and that of certain Polyzoa.

The first connected account of the development was given by Gilchrist (1917). He collected the eggs and larvae of *C. gilchristi* from the coast of South Africa and attempted to rear them artificially. During the first year of his work he was able to obtain all the early stages from the beginning of segmentation up to the free-swimming larval stage; but during the second year, when he repeated the trawling operations, he was not able to get even the adult colonies, so that further observations were rendered impossible. He described the segmentation, the origin of yolk, endoderm, the coelomic cavities, the pigment granules and the structure of the free-swimming larvae. Though some of his observations are open to doubt, his account of the early segmentation is a very valuable help for all further research.

The material for the present paper was obtained in an unexpected manner from the collections of the Terra Nova Expedition, which are now preserved in the Natural History Museum. When I was engaged in reporting on the *Cephalodiscus* of the Discovery Expedition I was kindly permitted by Miss Hastings to examine the Terra Nova collections. On one occasion I was prompted to collect some of the sediment which had settled at the bottom of jars containing colonies of *C. nigrescens*. I examined this in October 1932 and discovered twenty-one larvae in different stages of development, and two embryos. These I showed to Prof. E. W. MacBride, F.R.S., and at his kind suggestion this work was undertaken.

As there were only a very limited number of specimens, whole mounts were not made, and though every precaution was taken in preparing the sections the results were not quite satisfactory, owing to the fact that the material was very old and imperfectly preserved. The description of the genital organs and buds is based on Discovery material of *C. nigrescens*.

I take this opportunity to record my deepest gratitude to Prof. E. W. MacBride, F.R.S., for his kind help and encouragement and the facilities he gave me for carrying out this work in the Huxley Laboratory of the Imperial College of Science and Technology. I am also indebted to Miss Hastings, who is in charge of the Prochordate section in the Natural History Museum, for kindly permitting me to examine the Terra Nova collections.

GENERAL CONSIDERATIONS

The zooids of *Cephalodiscus* are either unisexual or hermaphrodite. The colonies of *C. dodecalophus*, *C. levinseni* and *C. gracilis* have been found to contain only female zooids in the specimens so far obtained, while the colonies of *C. nigrescens*, *C. densus*, and *C. kempi* are formed of male, female and hermaphrodite zooids. In these species the three different kinds of zooids are not differentiated by external characters, so that it is impossible to identify them except by sectioning the adult zooids. On the other hand the two species *C. hodgsoni* and *C. sibogae* show striking instances of dimorphism. In *C. hodgsoni* the female zooids are crimson-brown and possess twelve arms, while the male zooids are pale brown and possess ten or eleven arms. Some colonies are formed of both male and female zooids, while others are entirely of one sex. In *C. sibogae* the ordinary zooids are usually completely sterile or neuter individuals, in which the reproductive organs are vestigial. The male zooids are entirely different in appearance and are found in the basal jelly of the colony. They possess only a single pair of arms without pinnules. The alimentary canal is vestigial and there is no trace of a glandular stomach. It is believed that these male zooids are nourished through the vascular system by the neuter individuals.

In the male zooids of *C. hodgsoni*, *C. nigrescens* and *C. densus* the testes are a pair of organs symmetrically placed, one on either side of the median line, in the anterior part of the trunk cavities between the pharynx and the anus. Each testis is a small ovoid body with a narrow lumen in the centre. The testis therefore appears like a thick-walled hollow sac, the lining epithelium of which gives rise to the spermatozoa. The lumen of the testis is continued into a short narrow tube, the vas deferens, which opens externally. I was not able to discover any trace of pigmentation in the vas deferens or in the ectoderm surrounding its external opening. In *C. sibogae* the two testes are large and fill the greater part of the trunk cavities. Their structure is not clear from the account of Harmer (1905), probably because the zooids were imperfectly preserved, but it would appear from the description of his figures that the lining epithelium is comparatively thin, and that it surrounds a large central cavity which is filled with ripe spermatozoa.

In the female zooids the ovaries are conspicuous organs and in a mature specimen of *C. fumosus* they appear like swellings on either side of the anterior part of the trunk (John, 1931, pl. xxxv, fig. 3). Each ovary is an ovoid or flask-shaped body which is filled with a varying number of immature eggs. In an adult individual one or two eggs, at the end furthest from the external opening, are large and well developed and fill the greater part of the ovary. In *C. gilchristi* each of these large eggs is lodged in a follicle of small cells, while Schepotieff (1909) has described the large ova of certain species as lying between a central lumen, clothed with epithelium, and the wall of the oviduct, in a position where they are surrounded by a large quantity of blood. The indication of a central lumen in the ovary is also suggested by Harmer (1905), but no trace of any lumen has been observed in any of the species collected by the Discovery Expedition.

The oviduct is a thick-walled pigmented tubular prolongation of the anterior end of the ovary, and its external opening corresponds in position to the external opening of the male duct. In some species, such as *C. levinseni* and *C. dodecalophus*, the external opening of the oviduct is situated at the dorsal end of an ectodermal recess.

Gilchrist suggests that the ova originate from the wall of the oviduct, but this view is not supported by any convincing evidence. Very little is known about the origin of the oviduct and its homology. From a comparative study of the developing buds and young zooids it would appear that it is an ectodermal invagination, to the proximal end of which is attached the primitive germ cell, surrounded by a thin mesodermal epithelium. The oviduct is deeply pigmented like the red line on the ventral wall of the proboscis. In addition to this red pigment the ectoderm of the trunk carries a black or brown pigment in *C. nigrescens* and *C. fumosus*. In the developing buds and larvae, which will be described later, pigment granules are confined only to the ectoderm. If, therefore, the occurrence of the red pigment in the wall of the oviduct is taken as evidence for deciding its homology, there can be no doubt of its ectodermal origin. The proximal end of the pigmented tube is continued into a very short unpigmented part, which in turn opens into the ovary. This latter part is more clearly seen in the figures given by Harmer (1905, pl. xii, figs. 153, 154) than in my own sections. The continuation of this tube with the lining epithelium of the ovary suggests that it is mesodermal in origin. The oviduct is therefore really formed of two parts: a distal pigmented tube, which arises as an ectodermal invagination, and a short proximal part which is probably mesodermal in origin. According to this view the ectodermal recess in *C. levinseni* and *C. dodecalophus* is the anterior part of the invagination, which serves as a receptacle into which the egg is extruded before it is finally liberated from the body of the parent.

It has already been stated that in the immature condition each ovary is filled with five or six eggs, which are almost of the same size, but of these only one or two eggs reach maturity, the others being probably used up as food by the developing eggs. Each egg is composed of a large cytoplasmic part, which stains very lightly in haematoxylin, and a conspicuous nucleus, which is situated basally. The nucleus is of a clear homogeneous appearance and is spherical or oval in shape. As the present material was not fixed for cytological purposes it is not possible to give details, but Gilchrist (1917) has observed that there are faint indications of chromatin elements and that a conspicuous deeply staining nucleolus is always present. The protoplasmic part is filled with oval or rounded bodies which ultimately give rise to yolk granules.

The extrusion of the egg and the mode of sperm transference in *Cephalodiscus* are not known. Masterman suggested that the eggs are liberated at the death of the mother zooids; but in *C. densus* and *C. fumosus* the developing eggs have been found at the bottom of some of the tubes, containing in their upper parts zooids which were probably not dead till the time of fixation.

DEVELOPMENT

SEGMENTATION

The early development of *Cephalodiscus* was first successfully worked out by Gilchrist (1917), who was able to study the early stages with artificially reared eggs of *C. gilchristi.* Segmentation is total and equal up to the four-celled stage; but the succeeding divisions are unequal, probably owing to the great amount of yolk present in the egg. The four-celled stage gives rise to a six-celled embryo, which now assumes an oval shape and shows the commencement of a blastocoelic cavity. A perfect blastula is formed in the nine-celled stage. The blastocoel is now a wide space filled with a clear homogeneous substance. As the result of further division the blastocoel becomes wider, and at a stage when the embryo consists of about fourteen cells in section, one of the cells at the posterior end proliferates and the daughter cell thus formed sinks into the blastocoelic cavity. During the subsequent stages the cells become more and more differentiated, so that the anterior and posterior ends can be distinguished. The blastomeres, which were till now spherical, become elongated in the anterior end, and this transformation slowly extends towards the posterior end until all the cells assume the same shape. While these changes are taking place in the structure of the embryo, a group of three cells situated at the extreme posterior end continues to proliferate daughter cells into the blastocoel, until the latter becomes completely filled with a solid mass of cells. The elongated cells of the external layer are called columnar cells. These now begin to break up so that cell outlines are completely obliterated. The breaking up of the cell outlines of the external layer of cells has been attributed to the abundance of yolk. The embryo now measures about 0·8 mm. in length and a longitudinal section of it is represented in Plate XLIII, fig. 1. The external layer is formed of deeply staining protoplasm, which carries numerous rod-shaped bodies, the yolk columns, which are represented by the dark thick lines in the figure. These are formed by the close juxtaposition of each of the multiplying nuclei with a line of yolk granules after the cell outlines are broken up. The protoplasm also carries numerous small pigmented bodies, which are probably excretory matter accumulated in the tissue. They first appear as small black or brownish bodies, which increase in size and fuse together into elongated large masses. It is probable that in *C. nigrescens* and *C. fumosus*, in which the body is coloured brown or black, this pigment remains in the tissue permanently, while in others it is finally extruded from the surface.

One of the sides of the embryo, probably the ventral, is comparatively thick and is formed of elongated cells, which closely resemble those forming the thickened wall of the proboscis. This has been termed the ventral thickening, and Harmer (1905) believed that it somehow becomes converted into the proboscis of the adult. This comparison is strongly emphasized in my own figures of the embryo and the later larval stages, though I have not been able to show how the transformation takes place.

The inner part of the embryo, which represents a wide blastocoel, is filled with a solid mass of yolk granules. Gilchrist (1917) maintains that below the external layer a few cells appear, which become closely applied to the yolk granules. As the yolk granules in this layer are used up, each of the cells sends out a long protoplasmic process towards the adjacent ones on each side, so that ultimately they form a chain of cells which gives rise to the endoderm. If any such cells are present on the outer surface of the yolk mass, they must be clearly distinguishable from this mass; but his own drawings do not throw much light on this point, nor does he seem to be certain of their exact place of origin. According to this view the endoderm originates by a process of unipolar proliferation of the cells into the blastocoel. The cellular structure of these cells breaks down, and while some of the nuclei with the associated protoplasm go to form the endoderm, others pass towards the centre and become vitellophags. The same opinion was maintained by Harmer (1905), but Andersson (1907) questioned the accuracy of this statement and said that at least in his species the endoderm originates by typical invagination. Unfortunately he was not able to carry out any study of the cellular structure. Owing to the imperfect preservation of the material the ectoderm and endoderm appeared uniformly filled with yolk granules, which were, however, absent from the immediate neighbourhood of the central lumen. Schepotieff (1909), who found gastrula stages in *C. indicus*, also maintains that the endoderm is formed by invagination.

Between these divided opinions it is difficult to say which represents the correct mode of origin of the endoderm. I have not been able to obtain any of the intermediate stages between the solid blastula and the early larval stage which shows the origin of the coelom; but from a consideration of the structure of the latter I am more inclined to agree with Andersson.

Judging from the quantity of yolk present inside the blastula one would infer that a considerable time elapses before the commencement of further changes. During this interval cilia develop on the outer surface of the body and the embryo leaves the parent colony as a planula-like larva, which has been observed by Andersson (1903). During this free-swimming planula stage the inner mass of yolk is slowly absorbed, leaving a homogeneous detritus in which irregular cavities appear. The excretory matter accumulates in the external layer and a few refractive beads also appear in the dorsal wall, i.e. the side opposite the ventral thickening.

The progressive diminution in the quantity of yolk causes the outer surface of the yolk mass to shrink from the external layer, thus leaving a considerable space between the two layers. At this stage (Harmer, 1905, pl. xiv, figs. 198, 199, 208), the yolk mass is attached to the outer layer only by a short stalk-like process at one end, which is probably the posterior; so that absorption takes place only through the cells in this region. The real coelomic cavities originate only at a later stage in development: the five body cavities of the embryo described by Gilchrist (1917) seem only to be parts of this space, formed between the yolk mass and the external layer, which have been mistaken for true coelomic pouches.

LARVAL STAGES

When the greater part of the yolk is absorbed, the blastocoelic cavity becomes an empty space traversed only by a few protoplasmic strands, and the larva shrinks considerably in size. An invagination now commences in the region where the stalk of the yolk mass was originally attached. By this process a typical gastrula is formed. The gastrula stage has been recorded by Andersson; but its subsequent development, the formation of the mouth and the transformation of the ventral thickening into the proboscis region, is at present unknown. The youngest larvae which I have obtained represent a rather advanced stage in which the mouth is already formed and the proboscis region is well marked (Plate XLIII, fig. 2). The outer wall of the proboscis is very thick and is formed of large glandular cells, which stain very deeply in haematoxylin and in which masses of brown pigment are very conspicuous. The collar region on one side is very prominent and the ectoderm of the trunk and collar is formed of large columnar cells, which carry numerous refractive beads. These are homogeneous transparent bodies which are embedded in the cells of the ectoderm. In the adult zooid of *C. hodgsoni* and *C. dodecalophus* they are found at the tip of the arms, while in *C. densus* they are found in the dorsal wall of the proboscis and in the dorsal wall of the arms. Both in the adult zooids and in the larvae they are sometimes found partially extruded from the surface of the ectoderm. Throughout the larval stages and in the young zooids which develop from the larvae the refractive beads are found in large numbers in the ectoderm of the trunk; but when the young zooid settles down and begins to construct the coenoecium, they disappear in the body wall and become restricted to the tips of the arms. It is therefore possible that these refractive beads are the main defensive organs during the free-swimming larval stages of development. The fact that they are not found on the trunk or arms of the young buds constitutes one of the chief differences between the habits and structure of the two.

The gut opens externally through a narrow mouth situated antero-ventrally, and its walls are formed of cells which are somewhat shorter than those of the ectoderm. The mouth is roofed over by the inner wall of the proboscis, and its floor is formed by a short swelling of the anterior end of the trunk, which represents the future post-oral lamella. The mouth leads into a wide cavity, which becomes slightly narrow as it approaches the posterior end, and ends blindly, the anus not being yet formed.

The right and left coelomic pouches are seen on each side between the archenteron and the ectoderm. The right coelom has completely separated itself into three parts. The proboscis coelom (Plate XLIII, fig. 2, *pc*) appears like a solid rod of cells, while in the collar and trunk regions the beginnings of the respective cavities are visible. On the left side the coelomic pouch is still connected with the wall of the archenteron and appears like a single long pouch, the two walls of which are in close contact (Plate XLIII, fig. 2, *cp*). At its anterior end it is slightly thicker, and in this region it is connected with the wall of the archenteron. This condition of the left coelomic pouch throws considerable light on its possible mode of origin. Though the cells lining the walls of the coelomic pouch appear to be slightly different from those of the archenteron, in the region where the two are connected they are almost similar. This single pouch severs its connection from the wall of the archenteron, and later the anterior third of its length is cut off by a constriction, thus giving rise to the collar and trunk cavities. This condition is seen on the right side, which has developed more rapidly than the left.

It is difficult to say definitely from which side the proboscis coelom originates; but from the fact that the right side represents a more advanced stage in the development of the coelom, it is probable that the mass of mesodermal cells in the proboscis is constricted off from the anterior end of the right coelomic pouch.

The proboscis is situated at the anterior end, and its outer wall is thick. The larva now elongates slightly and the anus is formed at the posterior end. Plate XLIII, fig. 3, represents a larva at this stage which has been cut slightly obliquely, so that the proboscis coelom and the mouth are not quite visible. It has now an almost worm-like appearance, with a prominent swelling on the dorsal side which marks the commencement of the first pair of arms (Plate XLIII, fig. 3, *ra*). The proboscis still occupies the anterior end, and part of the proboscis coelom (*pc*) is seen towards one side. The masses of pigment which were till now uniformly distributed in the wall of the proboscis are now accumulating towards the outer surface, from which they will be extruded in due time. The mouth is situated ventrally and the alimentary canal is an almost straight tube with the anus at the posterior end. Near the posterior end there is a small bend in the alimentary canal, which marks the commencement of the U-shaped structure of the adult.

The body cavities are not very distinct, but part of the trunk coelom is seen on the dorsal side of the alimentary canal. The dorsal part of the collar cavity extends as a wide space into the rudiment of the arms, and the right and left halves extend round the alimentary canal and meet on the ventral side in the small swelling, behind the mouth, which represents the post-oral lamella. At this stage the larva resembles *Balanoglossus*. It is worm-like and elongated in the antero-posterior axis. The proboscis is at the anterior end and the anus at the posterior. The collar cavities surround the pharyngeal region like a ring and the mouth opens ventrally; but this larva differs from the larva of *Balanoglossus* in that the gill slits are not present and that the rudiments of the first pair of arms have already appeared on the dorsal side of the collar.

The larva has now reached its maximum development, and in the next stage it has all the characters of a young *Cephalodiscus*; the alimentary canal is U-shaped and the proboscis shifts towards the ventral aspect. This transformation, since it is accompanied by so many changes, can be regarded as a metamorphosis.

Plate XLIII, fig. 4, is a median longitudinal section of a young *Cephalodiscus* which shows almost all the characters of the adult. Though the alimentary canal is U-shaped, it is a uniform tube, which is not differentiated into pharynx, stomach and intestine. The postero-dorsal half of the tube is slightly wider and a lumen is clearly seen, but the entire wall of the alimentary canal is still formed of cells which are similar in shape and structure. Behind the mouth two diverticula are developed from the dorsal wall of the pharynx. The first diverticulum, which is slightly longer than the other, tapers slightly, and is directed forwards between the right and left collar cavities into the base of the proboscis cavity. This gives rise to the notochord, though at this stage it is formed of cells which are similar to those of the alimentary canal. The second diverticulum is much smaller and is directed dorsalwards. It touches the dorsal body wall at the posterior end of the brain and is called the pharyngeal diverticulum. As the section passes through the median line the paired arms and the collar cavities are not seen. The proboscis cavity is much compressed, but the ventral part of the trunk cavity is very spacious and extends posteriorly into a small sac-like part which marks the origin of the stolon.

Plate XLIV, figs. 1, 2, are transverse sections of the collar and trunk regions of a young individual slightly older than the one represented in the previous figure. These show more details of structure, especially of the coelomic cavities. The notochord is situated between the collar cavities and the proboscis. Its lumen is comparatively wide and is filled with a deeply staining substance. Nuclei and cell limits are clearly visible in its wall.

The mesodermal cells lining the proboscis and collar cavities have multiplied considerably, so that they not only form the thin lining epithelium of the coelom but fill the greater part of the cavities. In the proboscis cavity they are aggregated into two prominent clusters on either side of the notochord, and from these clusters protoplasmic strands extend towards the ventral wall. These give rise to the bundles of transverse muscles of the proboscis, which radiate from the septum between the proboscis and the collar cavities (John, 1931, p. 250).

The ectoderm of the trunk is very thick and carries large numbers of refractive beads. The cellular structure of the alimentary canal and the mesoderm is very distinct (Plate XLIV, fig. 2). The stomach is a thick-walled tube with a narrow lumen. The coelomic epithelium forms a continuous lining of the body cavities. On the dorsal side, the right and left body cavities do not meet, as the intestine is pressed closely against the dorsal body wall; but ventrally the two cavities become slightly wider and meet along the median line, giving rise to the ventral mesentery. The enlarged ventral part of the trunk coelom, which has already been referred to, is filled with large numbers of mesodermal cells. These give rise to the muscles of the stalk and the postero-ventral longitudinal muscles.

The heart with the pericardium is observed for the first time at this stage. It is situated at the tip of the notochord, on the septum between the collar and proboscis cavities. Though it is formed at an earlier stage, owing to the bad state of the material it has not been possible to locate its position or trace its origin; but from its relation to the collar cavities and its structure, in which it closely resembles the heart of Echinoderms, e.g. *Asterias rubens* and *Echinus miliaris*, it seems probable that it originates exactly as in the latter group (Narasimhamurti, 1932).

The further development is not accompanied by any more changes. All the parts of the adult zooid except the stalk are now visible. The anterior diverticulum of the pharynx, which gives rise to the notochord, is still formed of cells which are undifferentiated from the rest of the alimentary canal, and the muscle fibres are not fully formed. The mesodermal cells in the coelomic cavities are oval with distinct nuclei, but the protoplasm of some of these cells has already commenced to elongate into strands. The stomach is a thick-walled tube, which is not clearly marked off from the pharynx and intestine. The gill slits and the vacuolated areas of the pharynx—the pleurochords—are not yet formed, and there is only a single pair of arms. The brain is developed at the base of the dorsal ectoderm of the collar and extends from the anterior end of the notochord to the tip of the dorsal pharyngeal diverticulum; but the various nerve tracts and the nerve plexus in the ventral wall of the proboscis are still indistinguishable.

In the next stage the different parts of the body are much better emphasized, but the young *Cephalodiscus* still appears to continue its free-swimming life, if one may judge by the large number of refractive beads present in the wall of the trunk. Plate XLIV, fig. 3, which is a frontal section of a young zooid, illustrates the very close resemblance between this stage and the adult individual. The red line of pigment and the nerve plexus (*pni*) in the ventral wall of the proboscis have begun to appear and the mesodermal cells are completely transformed into muscle fibres. The stomach has begun to assume the characteristic shape of the adult and the intestine appears as a long narrow tube; but from the sections it is not certain whether the pleurochords and gill slits are yet formed.

The structure and position of the heart is very clearly seen. It is situated on the septum between the right and left collar cavities, slightly more towards the left side of the median septum, and it projects into the proboscis cavity. The pericardium is an empty sac, the posterior wall of which is invaginated to form the heart. The inner surface of the wall of this invagination is thrown into numerous deeply staining ridges which give rise to the glomeruli.

It is not necessary to give any more details of structure, as the young *Cephalodiscus* now resembles the adult in all essential characters, except the arms and the stalk, which are still in a rudimentary state. It seems probable that while the full complement of arms with the characteristic pinnules are being formed, the refractive beads in the trunk disappear, the young *Cephalodiscus* settles down on a suitable substratum and begins to secrete the coenoecium as the starting-point of a new colony.

DEVELOPMENT OF THE BUD

As the embryonic development of *Cephalodiscus* is very different from that of the buds an interesting study is afforded by a comparison of the two. The buds are formed from the sucker-like proximal end of the stalk on either side of the median line. In its earliest recognizable condition the bud is a spherical vesicle which originates as a diverticulum from the interior of the parent stalk. The trunk coelom, which is continued into the stolon, is completely filled with muscle fibres and connective tissue, and the rudiment of the young bud is completely packed with this tissue. This tissue, which is mesodermal in origin, soon arranges itself in such a way as to give rise to a cavity in the middle, which communicates with the trunk coelom in the stolon. The bud emerges from the surface of the stolon as a small knob which rapidly increases in length. The single cavity inside it divides into two by the development of a median mesentery, and later a small spherical vesicle is cut off from the distal end of one of the cavities: this has been regarded as the pericardial sac. The proboscis cavity is believed to be cut off in a similar way from the tip of the other cavity. The two posterior cavities, which are in communication with the cavity of the stolon, give rise at a later stage to the paired trunk and collar cavities.

As the bud continues to grow, it becomes slightly thicker at its distal end and the stalk by which it is attached to the stolon continues to increase in length. The proboscis now appears at the distal end of the bud. At first it is a small bulb-like structure marked off from the rest of the body by a small constriction (Plate XLIV, fig. 5). It develops very rapidly and assumes the flattened disc-like structure of the adult. The red line appears on its ventral wall and the posterior lobe formed by the two layers of ectoderm without an extension of the coelom is also differentiated at an early stage (Plate XLIV, fig. 4, *rl* and *pl*). From the dorsal side of the collar region the arms begin to develop, and by this process when all the parts of the body are unfolded the bud breaks off from the parent stolon and becomes an independent zooid.

The number of buds produced by each zooid varies in the different species. In *C. densus* and *C. fumosus* ten to fifteen buds are found, whereas in *C. kempi* two to five seem to be the maximum number (John, 1931, pl. xxxv, figs. 1, 2, 3).

According to Harmer (1905) and Masterman (1900) the alimentary canal in the bud makes its appearance as an ectodermal invagination, the orifice of which persists as the mouth; but the sections which I have obtained are not in agreement with this view. Plate XLIV, fig. 4, is a highly magnified part of a sagittal section of a young bud of *C. nigrescens*. The trunk is in the form of a narrow tube only slightly thicker than the stalk. The body wall is filled with aggregations of pigment granules, which give the characteristic colour of the species. The proboscis is very large and the anterior part of its ventral wall is thick and glandular. The arms and mouth are not yet formed, but the alimentary canal is represented by a straight tube which extends downwards from the base of the heart. Below the posterior end of the primitive gut there is an irregular mass of protoplasm, which fills the greater part of the right and left trunk cavities. This is probably derived from the mesodermal structures of the parent stolon, which at a later stage give rise to the muscles and connective tissue of the trunk.

The heart with the pericardium is a large thick-walled vesicle, which at this stage is slightly larger than the primitive gut. The invagination of the posterior wall of the vesicle giving rise to the heart is clearly seen. The large space inside the heart is filled with a clear fluid, which stains deeply in haematoxylin.

At a later stage, when the arms have begun to develop, the mouth is formed as an ectodermal invagination which opens into the lumen of the primitive gut at about one-third the distance from its anterior end. The region in front of the mouth opening becomes modified into the notochord, while the posterior part gives rise to the alimentary canal. Fowler (1905), in describing the development of the buds in *Rhabdopleura*, states that probably the greater part of the alimentary canal is derived from a thin-walled tube, which originates from the mesentery of the stolon. He believed, however, that the anterior part of the alimentary canal was derived from the ectoderm and that the notochord was formed from the stomodaeal portion. Though the origin of the alimentary canal in the buds of *Cephalodiscus* is to a great extent similar to that of *Rhabdopleura*, it can be definitely shown that in the former group the notochord is a part of the primitive gut and not a stomodaeal growth.

DISCUSSION

LARVAL AND BUD DEVELOPMENT

The differences between the development of the larva and bud of *Cephalodiscus* may be summarized as follows:

(i) The bud is attached to the proximal end of the stolon by a narrow stalk, the length of which increases with the growth of the bud. The trunk region of the bud is a continuation of the distal end of the stalk, there being no discernible difference between the thickness of the two during the early stages.

(ii) The proboscis of the bud is much larger than the rest of the body and is characterized by the presence of the red line from a very early stage; whereas in the larva the red line is not visible and the proboscis is comparatively much smaller.

(iii) The bud breaks off from the stolon only after it has reached its maximum development, but the larva is free-swimming or crawls about independently.

(iv) In the buds the refractive beads are found only in the tips of the arms or in the dorsal wall of the proboscis; but in the larva these are present in very large numbers in the ectoderm of the trunk. If the view that these refractive beads are defensive organs should prove to be correct, then it follows that their occurrence in such large numbers in the body wall of the larva is sufficient evidence for the free-swimming or crawling habits of the larva. These refractive beads are not present in the trunk wall of the bud or of the adult zooid, as the bud is not exposed to danger and the trunk of the adult is protected inside the coenoecium.

(v) The alimentary canal in the bud originates from a rod-shaped primitive gut and the coelomic cavities are derived from the cavity of the stolon; but in the larva the archenteron, which gives rise to the alimentary canal, is formed by invagination and the coelom originates as pouches from the sides of the archenteron.

(vi) The stalk of the bud persists after the bud breaks away and gives rise to the stolon of the adult, from the proximal end of which new buds are formed. In the larva no trace of a stolon is present until the young individual settles down.

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PLATE XLIII

Cephalodiscus nigrescens, Lankester

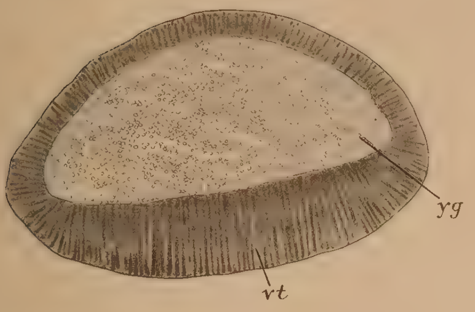
Fig. 1. Median longitudinal section of an embryo showing the ventral thickening and the inner mass of yolk granules.

Fig. 2. Longitudinal section of a young larva showing the formation of the coelomic cavities.

Fig. 3. Longitudinal section of a larva of a later stage, in which the alimentary canal is a straight tube with the anus situated at the posterior end.

Fig. 4. Longitudinal section of a very young *C. nigrescens*.

a, proboscis; *al*, alimentary canal; *an*, anus; *arch*, archenteron; *b*, brain; *cc*, collar cavity; *cp*, undivided coelomic pouch connected with the archenteron; *d*, notochord; *m*, mouth; *pc*, proboscis cavity; *pd*, dorsal pharyngeal diverticulum; *pg*, pigment granules; *ra*, rudiment of the first pair of arms; *rb*, refractive beads; *tc*, trunk coelom; *vp*, ventral prolongation of the trunk to give rise to the stolon; *vt*, ventral thickening; *yg*, yolk granules.



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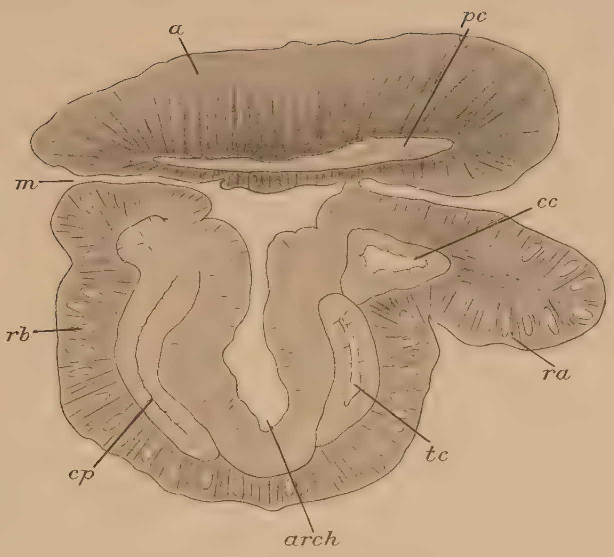
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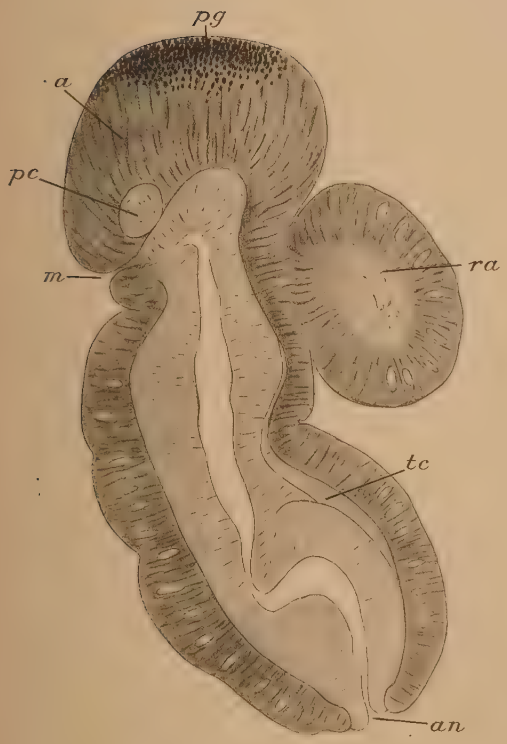
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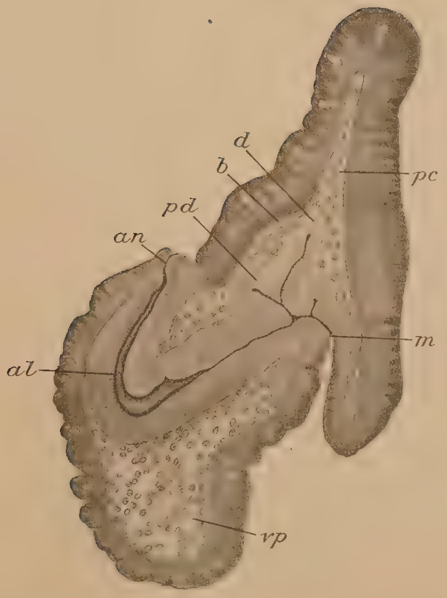
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DEVELOPMENT OF CEPHALODISCUS.

PLATE XLIV

Cephalodiscus nigrescens, Lankester

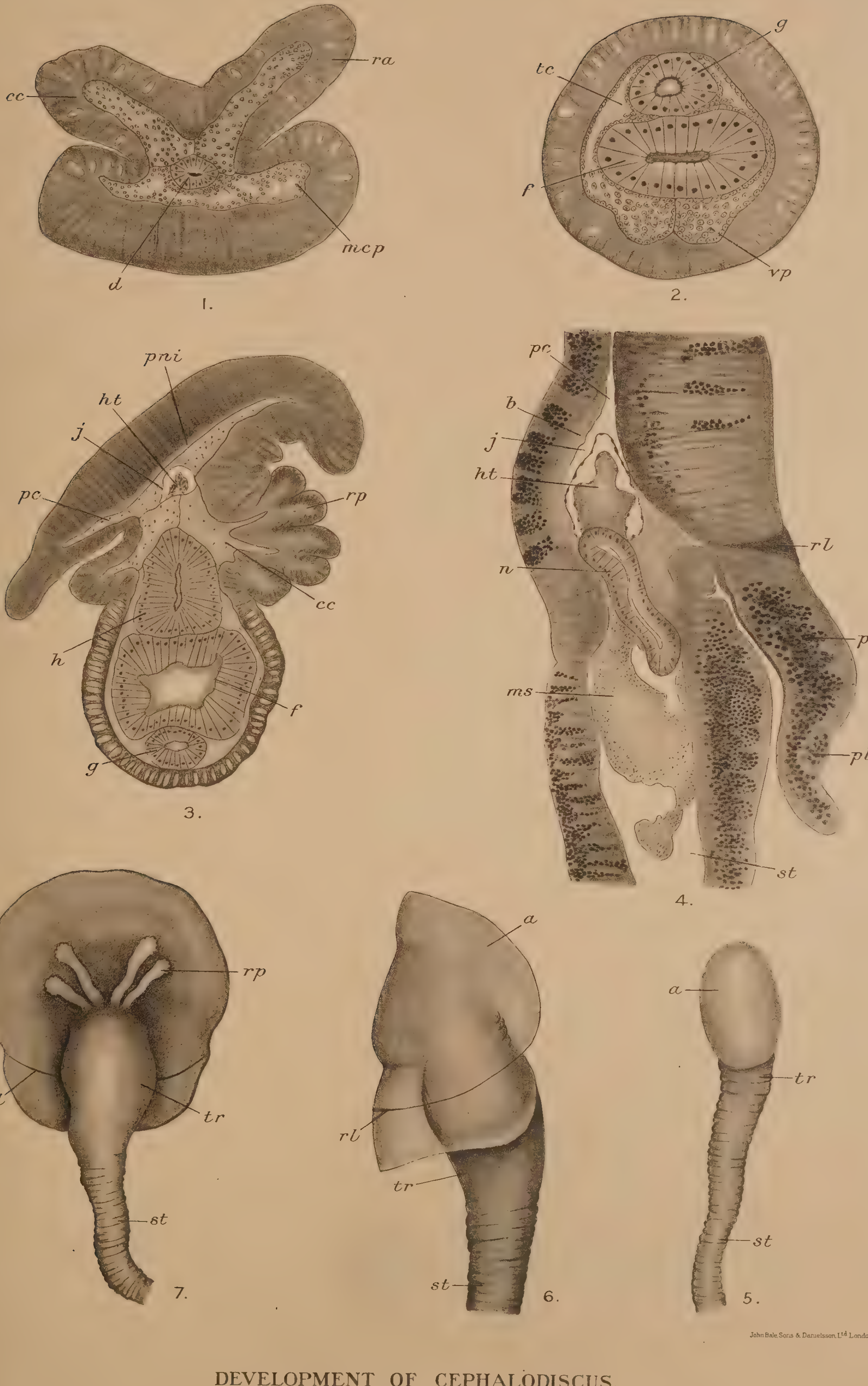
Figs. 1, 2. Transverse sections of a young *C. nigrescens* passing respectively through the collar and trunk-region.

Fig. 3. Frontal section of a young *C. nigrescens* slightly older than the one represented in Figs. 1, 2, showing the growth of paired arms and the relations of the heart and pericardium.

Fig. 4. Sagittal section of a young bud.

Figs. 5, 6, 7. Drawings from whole mounts of three stages in the development of the bud.

a, proboscis; *b*, main ganglion; *cc*, collar cavities; *d*, notochord; *f*, stomach; *g*, intestine; *h*, pharynx; *ht*, heart; *j*, pericardium; *mcp*, mesodermal cells in the proboscis cavity forming muscular strands; *ms*, mass of mesoderm in the trunk cavity of the bud, derived from the stolon of the mother zooid; *n*, primitive gut; *pc*, proboscis cavity; *pg*, pigment granules; *pl*, posterior lobe of the proboscis; *pni*, nerve plexus in the ventral wall of the proboscis; *ra*, first pair of arms; *rl*, red line in the proboscis; *rp*, rudiments of the paired arms; *st*, stalk with which the bud is attached to the stolon of the mother zooid; *tc*, trunk cavity; *tr*, trunk-region of the bud; *vp*, ventral part of the trunk cavity with clusters of mesodermal cells enlarging to form the stolon.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DEVELOPMENT OF CEPHALODISCUS.

[*Discovery Reports. Vol. VI, pp.* 205–236, *Plates XLV–XLVII, Charts* 1–7 (*separately*), *December*, 1932.]

REPORT ON SOUNDINGS TAKEN DURING THE DISCOVERY INVESTIGATIONS, 1926–1932

By

H. F. P. HERDMAN, M.Sc.

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REPORT ON SOUNDINGS TAKEN DURING THE DISCOVERY INVESTIGATIONS, 1926–1932

By H. F. P. Herdman, M.Sc.

(Plates XLV–XLVII; charts 1–7; text-figs. 1–5)

INTRODUCTION

This report covers all the oceanic soundings taken during the course of the Discovery Investigations from 1926 until April, 1932, in the following areas:

(i) In the Scotia Sea and surrounding waters from 51° to 62° S latitude between 20° and 70° W longitude.

(ii) In Bransfield Strait, the South Shetland Islands and the Palmer Archipelago.

(iii) In the Bellingshausen Sea.

In the first area are included intensive series of soundings round South Georgia and the Shag Rocks and some of the soundings taken during the running survey of the South Sandwich Islands in 1930. The soundings have been obtained by the R.R.S. 'Discovery' in 1926 and 1927, by the R.R.S. 'William Scoresby' in the years 1926–31 and from 1930 onwards by the R.R.S. 'Discovery II'. The majority of the soundings have been taken by the last-named ship and by the echo method. In the detailed discussion of these soundings prominence has mainly been given to those taken in oceanic waters. Inshore soundings taken round the South Sandwich Islands are included in the recently published report[1] on that group of islands. Intensive soundings in the bays and harbours of South Georgia have also been omitted, as they are included in the report on the survey operations round South Georgia by Lt.-Cmdr. Chaplin.[2]

In the 'Discovery' and the 'William Scoresby' difficulty was sometimes experienced in obtaining good wire soundings owing to the impossibility of keeping the sounding wires vertical in bad weather, and for this reason not all of their soundings can be accepted. In the 'Discovery II', however, it was possible to obtain reliable wire soundings in moderately bad weather by keeping the ship head-to-wind and steaming slowly ahead whenever necessary to correct the "stray" on the wire. Since echo soundings, however, can be taken every few minutes, and usually without stopping, the wire method was latterly abandoned. Approximately 10,000 echo soundings were obtained between February 1930 and May 1931, and of these the greater number were taken between December 1930 and March 1931. During the season 1931–2 approximately 2000 more echo soundings have been obtained, and on the evidence provided by all these soundings it has been possible to arrive at some definite conclusions as to the bottom relief in most of the above-named areas.

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[1] Kemp and Nelson, The South Sandwich Islands, *Discovery Reports*, III, pp. 133–98 (1931).

[2] Chaplin, Narrative of Hydrographic Survey Operations in South Georgia and the South Shetland Islands 1926–30, *Discovery Reports*, III, pp. 297–344 (1932).

The positions of all soundings obtained by the R.R.S. 'Discovery II' were determined by Lieut. A. L. Nelson, R.N.R., and the majority have been plotted by him on large-scale charts. His careful and painstaking work has been of the greatest assistance in the preparation of this report. Vice-Admiral H. P. Douglas, C.B., C.M.G., R.N. (retd.) and Mr J. M. Wordie have been kind enough to examine this report in manuscript and I am indebted to them for a number of valuable suggestions.

SOUNDING MACHINES

WIRE SOUNDINGS

For oceanic wire soundings the ships were fitted with the well-known Lucas sounding machine,[1] manufactured by the Telegraph Construction and Maintenance Co., which carries about 10,000 m. of 0·028 in. diameter single-strand bright steel piano wire in one length. This wire had a breaking strain of 220 lb. The ordinary Baillie sounding rod, also described in the *Discovery Reports*,[2] was used throughout for all soundings over 300 or 400 m., the weights being the usual cones and flats of about 22 lb. weight apiece. In shallow water, and sometimes up to 500 m., the Admiralty 28 lb. sinker was used, as was also a new pattern of bottom sampler designed by Mr F. E. C. Davies to bring up larger quantities of material than were usually obtained by the ordinary methods. Certain small defects which had been noted in the Lucas sounding machines fitted in the 'Discovery' and 'William Scoresby'[3] were overcome in the later pattern fitted in the 'Discovery II', which gave every satisfaction on the occasions when its use was necessary. Motor-driven Kelvin sounding machines were fitted in the 'Discovery' and 'Discovery II' and a hand-operated one in the 'William Scoresby'. In the 'Discovery II' this machine was seldom used except for the purpose of checking the accuracy of the shallow-water echo-sounding machine. The positions of the Lucas and Kelvin sounding machines in the 'Discovery' and 'William Scoresby' have already been discussed in the *Discovery Reports*. In the 'Discovery II' the Lucas sounding machine was placed on the port side of the forecastle head, about 12 ft. aft of the stem, and the Kelvin machine on the starboard side of the bridge deck close to the chartroom door, the wire being carried outboard by a boom and traveller.

ECHO SOUNDINGS

The echo-sounding machines are of the British Admiralty pattern, and with the exception of the experimental machine fitted in the 'Discovery' for a year, were manufactured by Messrs Henry Hughes and Son of London. The mechanical details of the oceanic and the shallow-water machines differ considerably, but the principle is the same: a blow from a hammer operating on the ship's hull produces a sound wave which is reflected from the bottom and picked up by a very sensitive hydrophone, and from the time interval between the transmission and the reception of the sound the depth of water can be calculated. Observations made at various times on the salinity and temperature of sea water have been used for the calculation of the velocity of sound in that medium.

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[1] Kemp, Hardy and Mackintosh, Objects, Methods and Equipment, *Discovery Reports*, I, pp. 168, 169, 190 (1929).

[2] Kemp, Hardy and Mackintosh, *loc. cit. supra*, pp. 210, 211.

[3] *Id.*, p. 168.

Shallow-water echo-sounding machine. In this machine the hammer is electrically operated and the speed of the transmitter switch is automatically adjusted by means of a governor and moving resistance to ensure approximately 180 blows per minute. The receiving gear, which is situated on the bridge, houses the transmitter switch and the telephone gear; from it the depth can be read off directly in metres, the corrections for salinity, temperature and pressure being negligible up to the extreme range of this machine—220 m. In practice this machine was seldom used for depths beyond 160 m.; for it was found more convenient to change over to the oceanic machine at this point in order to avoid any doubt as to whether soundings were shoaling or increasing when the limit of 220 m. was reached.

All the ships were fitted with the listening type, as distinct from the recording type, of shallow-water echo-sounding machine, but only in the 'William Scoresby' and the 'Discovery II' was it extensively used. In the former ship it proved very useful during the trawling survey of the Falkland Islands in 1927, as by taking soundings every few minutes when trawling, the length of warp paid out could be adjusted to any considerable change in depth. A later pattern of the same type of machine was fitted in the 'Discovery II', which gave considerably better results than the earlier model, though when in constant use for long periods, a considerable amount of attention was required to keep it in adjustment. Apart from some slight delays caused by minor mechanical defects, which were easily made good on board, and the leakage of water into the hydrophone through faulty assembling, the machine was in continuous use for weeks at a time over a period of fifteen months and gave excellent results.

The hammer was fitted under the stokehold on the port side of the double bottom between the oil-fuel tanks and the stokehold fresh-water tanks. Alternative positions were provided for the hydrophone, one at the after end of the double-bottom fresh-water tank on the starboard side of the fore hold and the other about 6 ft. farther aft in the double-bottom between the fresh-water tank and the starboard oil-fuel tank. After the hydrophone had been flooded in the fresh-water tank, it was shifted to the alternative position, but although there was still a tendency towards several false echoes, it worked quite satisfactorily. Neither position was entirely free from false echoes at certain points on the scale, but with practice the operator could easily distinguish the true echo from the false by the difference in note, and even when the true echo coincided on the scale with the false the note was unmistakable. When the 'Discovery II' was re-commissioned in 1931, the hydrophone was replaced in the fresh-water tank, where, with the exception of the recurrence of a trouble previously experienced, it has worked quite satisfactorily.

When the hydrophone was being overhauled in February 1931, while endeavouring to trace the cause of very faint echoes, it was found that the stalloy plate which forms the base of the hydrophone and on which the micro-button is mounted had been bent inwards towards the centre, thereby throwing the button out of alignment. This was no doubt due to the freezing of the fresh water in the chamber under the hammer, as it was against the hull and the temperature of the sea was about – 1·5° C. A new stalloy plate was fitted, glycerine added to the fresh water in the chamber to prevent freezing and no further trouble was experienced till 1932. When the hydrophone was replaced in the fresh-water tank in September 1931, glycerine was again added, but there appears to have been a small leak in the joint where the water chamber butts on the hull. This joint consists of a dermatite ring, and the hydrophone and water chamber are braced down on it by a strongback clamp. When the 'Discovery II' was again in water of – 1·0° C., the echoes, as before, became very faint, and on examination of the hydrophone it was found that the stalloy plate was again bent inwards and that all the glycerine had diffused into the fresh-water tank through the fault in the joint. This water chamber, which is fitted under both hammer and hydrophone in the shallow-water machine, is of great importance, as by pumping water into it till a pressure of about 20 lb. to the square inch is reached, the chamber acts much in the same way as a lens does with rays of light: it concentrates the sound waves and prevents the scattering of sound noticeable in the earlier models.

Oceanic echo-sounding machines. The deep-water echo-sounding machine fitted in the 'Discovery' in 1925–6 was an Admiralty experimental model. Owing to the difficulty of fitting this machine in a wooden ship, the hammer had to be slung outboard from a davit, and it was found that the rolling of the ship caused excessive water noises in the hydrophone. This, together with mechanical troubles due to the unusual position of the hammer, prevented the machine from working properly, and it was removed in 1926. The deep-water echo-sounding machine at present fitted in the 'Discovery II' is of the listening type and has a much more powerful hammer than the shallow-water instrument. The hammer is operated by compressed air, and controlled electrically from the receiving gear in the chartroom. Impulses can be sent out at three different rates, one, nine, and ten in 11·25 sec., which is the time taken to complete one circuit of the transmitter switch. Here, as in the shallow-water machine, the speed is controlled by a governor in conjunction with a resistance. In the 'Discovery II', however, this control was not always satisfactory when the machine was running for long periods, and it was necessary to check the speed of the transmitter switch at frequent intervals and correct the soundings accordingly. It was found after several experiments that the temperature inside the case of the receiving gear rose in 20 min. from 11·5° to 15° C., and that the time for a revolution of the transmitter switch fell from 11·22 to 10·93 sec. If the machine is only running for 3 or 4 min. at a time the error from this cause is, however, practically negligible, and the bulk of the oceanic soundings were taken under these conditions.

The impulse rates are selected at will by the operator, and to obtain a sounding it is usual to get the approximate time interval between hammer blow and echo on the one-impulse circuit and then tune in more accurately on the nine- or ten-impulse circuit. The reading obtained is in seconds and gives the time taken by the sound waves for their double journey, i.e. from the hammer to the bottom and back to the hydrophone. A skilled operator can easily determine the time correctly to 0·01 sec., which roughly corresponds to an error of 7 m., and the depth is quickly calculated after applying the necessary corrections. A book of correction tables[1] has been calculated by Mr D. J.

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[1] *Tables of the velocity of sound in pure water and sea water for use in echo-sounding and sound-ranging*, H.D. 282, H.M. Stationery Office, London (1927).

Matthews of the Hydrographic Department of the Admiralty, in which the oceans of the world are divided up, according to the salinity and temperature of the water, into areas in which the same corrections can be applied. Instructions are also given for working out new tables for any area from the hydrological observations. In this way tables were worked out in the 'Discovery II' for the South Georgia and Scotia Sea areas from the average of a large number of salinity and temperature observations, but the results were found to vary very little from those already determined by Matthews. A special table (see p. 236) extending to 7250 m. was compiled from observations in the South Sandwich Deep and was used for the correction of all soundings in that area.

The proved effective range of this oceanic machine was from approximately 90 to 8100 m., and the maximum depth at which soundings have been obtained with the ship under way was just over 5000 m. The limiting factors in obtaining soundings under way are water noises in the hydrophone caused by wind and sea—factors which may vary considerably. No definite statement can be made as to the best method of obtaining a sounding in bad weather; only actual experience of a ship's behaviour in different weather conditions will enable the operator to find the best way of manoeuvring the ship in order to avoid excessive water noises in the hydrophone. In the area where we were working heavy swells and high seas are unusually prevalent, but soundings up to 500 m. could nearly always be obtained. In deeper water it was sometimes necessary to manoeuvre the ship with regard to wind and sea. In our experience the time taken to complete a 5500 m. sounding under average conditions rarely exceeded 4 min., and even in very bad weather it was unusual to stop for more than 7 or 8 min. Only once during our intensive sounding programme was the weather sufficiently bad to prevent us obtaining any soundings and then conditions improved within a few hours.

The present instrument in the 'Discovery II' has the hammer fitted in the well between the engine-room and stokehold double-bottom tanks, on the port side. The hydrophone was fitted in the starboard oil-fuel well just beside the alternative position for the shallow-water hydrophone. The hammer is mounted on a water chamber in a manner similar to the arrangement of the shallow-water gear, but the base of this chamber consists of a special circular steel casting which is let into one of the bottom plates and consequently exposed to the sea. The hydrophone is enclosed in a sluice valve and can be lowered into the sea or withdrawn into the hull at will. Although the recommended position of the hydrophone for sounding was to lower it well clear of the hull we found that the best position in the 'Discovery II' was with the stalloy plate of the hydrophone flush with the hull, and we had no trouble in obtaining our maximum sounding of 8102 m. with it in this position.

During the first season, 1929–30, the machine was not altogether satisfactory mechanically, and in the middle of the South Sandwich Islands survey in March 1930, the hammer cylinder sustained a fracture and broke in half. Fortunately it was a clean break, and our Chief Engineer was able to devise a form of collar to hold the two parts together, enabling us to have the machine running again in a day or so. This fracture, however, necessitated a new hammer being sent out from England and fitted in Simonstown in July 1930. After this the machine worked extremely well, though like the shallow-water instrument it required constant attention during periods of continuous use. Much of its efficiency was due to the care and trouble expended on it by R. W. Mackay, the ship's technical assistant, and the engineering staff. One of their problems was the refusal of the piston of the hammer to move in very cold weather or its sudden stopping after it had been running for a few minutes. This was found to be due to the compressed air which comes over from the compressor quite hot.

This air gives up moisture on its sudden expansion in the cold hammer chamber causing a sticky emulsion to form with the oil used for lubricating the piston. The piston then sticks and it is necessary to take off the head of the hammer to remove the piston for cleaning at very frequent intervals. Eventually, while the ship was in cold waters, the hammer was run practically without lubricant, the piston being occasionally wiped with a rag which had been soaked in very thin oil. Even under these conditions it was still necessary to remove the piston for cleaning every 8 to 12 hours when the machine was in constant use. During the refit in London in 1931 the hammer was surrounded by a steam coil which has had the desired effect of preventing the condensation of the water from the compressed air. Another matter which required the frequent attention of the engineers was the air compressor itself, which was found to be inadequate for the long periods of continuous running demanded from it by the sounding programme. It was only by careful and continuous attention that the motor and bearings were prevented from wearing out completely, and as the ability of a compressor to run continuously for several days is a very important factor in our sounding work, a new compressor, with a much larger capacity and of heavier construction, was fitted in London in 1931. Trouble was also experienced with the reducing valve for regulating the pressure of air required to reset the hammer, but a new valve constructed on board overcame this difficulty.

From 1926 to 1929, when only Lucas sounding machines were being used in oceanic waters, soundings were usually taken when the 'Discovery' or the 'William Scoresby' was stopped for observations on hydrology and plankton. In the 'Discovery II' with an efficient deep-water echo-sounding machine it was possible to take soundings at much more frequent intervals, and on a number of occasions the machine was used day and night without intermission for weeks at a time. For station work the Lucas machine was superseded mainly on account of the great saving of time. A Lucas sounding to 5000 m., which is roughly the average depth of our oceanic stations, takes at least 1½ hours to complete. The ship requires to be constantly manoeuvred with regard to this one wire, and as the forward hydrological machine on the forecastle head of the 'Discovery II' is only 22 ft. aft of the Lucas sounding machine, it is impossible, except on very rare occasions, to work deep water-bottles when the Lucas sounding wire is out. An echo sounding on station does not take more than 5 min. to complete, and there is no hindrance to the deep water-bottles being lowered as soon as the ship is hove-to. In the variable weather conditions which prevail in the Scotia Sea, where the majority of our stations were worked, it was important to reduce the time taken for observations, and in this respect great advantage was obtained from the use of the echo-sounding machines. It is a testimony to their efficacy that at several hundred stations we relied wholly on soundings obtained in this way, and that instruments were constantly lowered to within a short distance of the bottom, even in the greatest depths, without ever coming in contact with it.

COMPARISON OF WIRE AND ECHO SOUNDINGS

At various times, mainly during the early part of 1930, comparisons were made by the 'Discovery II', when weather conditions permitted, between Lucas and echo soundings. The accompanying table gives the data obtained, the average of the 21 comparisons showing a percentage excess of Lucas depth over echo depth of 1·42. The greatest and least errors, in soundings of over 2000 m., were respectively 3·35 and 0·28 per cent. In the table the velocity of the wind is given in knots, and it may be assumed that when it falls below 10 knots the ship was being allowed to drift, as the force of the wind was not strong enough to enable us to adopt the usual practice of keeping the ship head-to-wind. Later, when several lines of echo soundings had been run, it was found that the crossing of a previous line gave a valuable check on the accuracy of the soundings, and in all the cases where two oceanic lines of echo soundings cross the agreement has been excellent.

Table of comparison between Lucas and echo soundings

Date	Station	Sounding (metres)		Wind		Excess of Lucas sounding %
		Lucas	Echo	Direction	Velocity (knots)	
20. i. 30	301	1858	1839	NNW	11	1·02
29/30. i. 30	319	2409	2347	NNE	22	2·52
30. i. 30	321	4117	3994	NE by N	18	3·35
4. ii. 30	334	3250	3233	WSW	16	0·52
4. ii. 30	335	3416	3377	W by S	18	1·14
5. ii. 30	336	3193	3115	N	7	2·44
7. ii. 30	343	960	936	W	9	2·56
9. ii. 30	353	1167	1134	NW	18	2·83
9. ii. 30	355	3714	3641	NW by N	20	1·96
10. ii. 30	356	3272	3204	NNW	12	2·08
10. ii. 30	357	3645	3616	NW	28	0·80
11. ii. 30	358	3549	3539	WNW	28	0·28
19. iii. 30	373	2515	2493	W by S	10	0·87
2. iv. 30	—	3213	3169	—	—	1·37
13/14. iv. 30	382	3652	3617	SSW	16	0·96
14. iv. 30	384	3663	3632	SE by E	15	0·85
15. iv. 30	385	3637	3612	ENE	23	0·69
15. iv. 30	386	4775	4734	Light airs	—	0·86
16. iv. 30	387	3102	3076	ENE	20	1·89
20. x. 30	460	3802	3730	ENE	22	0·84
30. x. 30	560	335	335	WSW	8	0·0

From exhaustive observations recently obtained by H.M. Surveying Ships in comparing echo and wire soundings at all depths up to 5000 m. it has been ascertained that the echo method is by far the most accurate. This is principally due to the fact that however carefully the ship may be manoeuvred there must be a divergence from the vertical which the wire takes up. This is obvious from the above table where the depths by the Lucas machine are all greater.

Up to the limit of the shallow-water echo-sounding machine soundings were usually taken every 1 or 2 min., depending on the scale of the survey which was being carried out and on the speed of the ship, but continuous soundings can be obtained if they are necessary for navigational purposes. Under normal conditions the interval between soundings was lengthened as the depth increased, till in oceanic waters it reached 30 or 60 min., depending largely on whether a stop of about 5 min. is required for the sounding. Certain oceanic work, however, such as the search for a reported rock or the detailed examination of a submarine ridge may require soundings to be taken as often as every 5 min., and up to a depth of about 800 m. soundings with the oceanic machine have been taken, in favourable circumstances, at 2 min. intervals.

THE SCOTIA ARC

One of the most interesting features of the topography of the bottom in the area of the Falkland Islands Dependencies is the supposition, much discussed by geologists, that the Andes formerly joined Graham Land and the South Shetland Islands to form a mountain arc or loop which extended eastwards into the South Atlantic. It is generally held that if there is such a connexion the probable course must have been from Tierra del Fuego through Staten Island, the Burdwood Bank, the Shag Rocks, South Georgia, the Clerke Rocks, the South Sandwich Islands, the South Orkney Islands, Elephant and Clarence Islands and the South Shetlands. This connexion, if it really exists, is not only of great interest from a geological point of view, but it is also of very great importance in the studies we are making of the hydrological conditions in the area, for if the missing portions of the arc are represented by submarine ridges, they will certainly exert a profound influence on the movements of the water masses in their vicinity.

Geological writers have generally referred to the supposed arc as the South Antillean Arc. There are, however, no South Antilles, and in view of the grouping of the fragments round the Scotia Sea, it seems preferable, as Mr Wordie has suggested, to speak of the connecting loop as the Scotia Arc.

The first mention of a possible connexion appears to have been made by Bellingshausen, of whom Suess writes:[1]

"*Second advance*: Bellingshausen after a visit to the South Sandwich Islands in 1819, during which he witnessed a volcanic eruption in Sawadowskij [Zavodovski], the most northerly of these islands, wrote as follows:—'The Sandwich Islands and the Traversey Islands appear to form the summits of a mountain ridge which is connected through Clerk's reef with South Georgia, and from there on by the Aurora reef with the Falkland Islands'".

Since Bellingshausen's time and before Suess' examination of all previous data, several other investigators, notably Barrow, Reiter, Arctowski, Nordenskiöld and Gunnar Andersson, had put forward similar theories.

Suess, after considering all the available evidence, regards it as established[2] "that in the interval we have just discussed *the Pacific structure advances for the second time into the Atlantic region*". It should be noted, however, that in Suess' opinion South Georgia does not form a continuation of the Burdwood Bank, but that an arcuate connexion through the Shag Rocks is more probable, and in his detailed comparisons[3] he observes that:

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[1] Suess, *The Face of the Earth* (authorized English Translation), IV, pp. 488, 489 (1909).

[2] *Loc. cit.*, p. 496.

[3] *Loc. cit.*, p. 495.

"(*e*) No connexion can be shown to exist between the widely remote volcanic indications of *Burdwood bank*, the volcanic arc of the *South Sandwich islands*, and the *Bransfield volcanos* (Bridgman, Deception, and others). The resemblance between the South Sandwich Islands and the volcanos of the lesser Antilles has often been remarked upon.

"Existing observations scarcely permit us to carry comparisons further. It must not be overlooked that Staten Island and Cape Horn do not present a completely concordant strike, and that Mount Oreille may mark perhaps the beginning of a new volcanic arc resembling the South Sandwich Islands more closely than Burdwood bank. Arctowski marks – 4040 meters a little to the south of Staten Island. The connexion of the other groups, such as South Georgia, the South Orkneys and the South Shetland islands, must remain an open question".

Suess also states that most modern investigators accept the hypothesis that the Andes are seen again in Graham Land.

Since Suess discussed the question, a considerable amount of geological work has been carried out in these regions, as a result of which Gregory, in his presidential address to the Geological Society in 1929,[1] strongly contested the theory of an arc along the line generally indicated. His objections were based mainly on various observations and collections made in South Georgia, by Ferguson in 1911–12[2], and Douglas during the visit of the 'Quest' in 1922.[3] Gregory also supported the conclusions arrived at by Kühn in 1920,[4] who maintained that the supposed extension of the Andes through South Georgia was supported neither by the geology of the island nor by the form of the adjacent sea floor. The geological evidence in 1920 may have been sufficient to warrant this statement about South Georgia, but at that time there were not, in my opinion, sufficient oceanic soundings in this area from which any conclusions could be drawn as to the form of the sea bottom round the island. As the result of all the evidence available in 1929, Gregory considered that South Georgia appeared to be "a fragment of an ancient South Atlantic land, and the south-western corner of the Flabellitesland of Schwartz". In coming to this conclusion, Gregory ignored the work of Heim in 1911[5] and Wordie in 1914,[6] who both maintained that Ferguson's interpretation of South Georgia was inadmissible.

Since then, however, Holtedahl[7] has made a considerable number of observations in South Georgia, the South Shetlands and some of the outlying rocks and islands, and confirms Heim and Wordie's views on the structure of South Georgia. In discussing the bearing of his observations on the problem of the South Antillean Arc, Holtedahl sees no reason to believe that South Georgia lies outside the main Andean line of folding.[1] He has also endeavoured to show that there is a distinct geological likeness between South Georgia and the Staten Island—Tierra del Fuego district. Concerning the remainder of the arc he remarks: "the fact that various types of rocks, or even rocks of no doubt different age, occur in various places, does not in any way contradict the assumption of these land-masses being parts of the same old range", and with regard to the South Orkneys he suggests that the divergence of the strike from the trend of the submarine ridge may be purely local as "we know from many ranges that the strike may locally diverge very considerably from the main trend of the folding belt".

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[1] Gregory, The Geological History of the Atlantic Ocean, *Quart. Journ. Geol. Soc. London*, LXXXV, pp. cix–cxi (1929).

[2] Ferguson, *Trans. Roy. Soc. Edin.*, L, pp. 797–816 (1915).

[3] *Geol. Coll.*, *Voyage of the 'Quest'*, pp. 51–54 (British Museum), 1930. See also *Nature*, CXXVI, p. 837.

[4] Kühn, Der sogenannte "Südantillen-Bogen" und seine Beziehungen, *Zeit. Ges. Erdk. Berlin*, pp. 249–269, especially pp. 255, 261 (1920).

[5] Heim, *Zeit. Ges. Erdk. Berlin*, No. 6, pp. 451–6 (1912).

[6] Wordie, *Trans. Roy. Soc. Edin.*, LIII, pp. 17–27 (1925).

[7] Holtedahl, On the Geology and Physiography of some Antarctic and sub-Antarctic islands, *Norweg. Antarct. Expeds.*, 1927–8 *and* 1928–9, No. 3, Oslo (1929).

Wilckens,[2] in his criticism of Staub's theory[3] of the non-existence of an arcuate connexion between the Andes and Graham Land, supports Holtedahl's contention that Tierra del Fuego and South Georgia are of a similar geological structure and, in general, considers that the existence of a submarine arc has been proved.

The bathymetric chart of the Scotia Sea shown by Pratje,[4] which is based mainly on the echo-sounding profiles of the 'Meteor' during 1925 and 1926, supports the theory of the island arc, though he shows a greater average depth between the Burdwood Bank and the Shag Rocks and between South Georgia and the Shag Rocks than actually exists. Comparison with our bathymetric chart of the same area (Plate XLV) will show that the depth here is considerably less than that given by Pratje.

The principal evidence that we are able to bring forward in regard to the Scotia Arc is derived from soundings, and, as will be seen from the charts and plates accompanying this paper, the soundings indicate clearly that well-defined submarine ridges exist between Graham Land and South America along the generally accepted line. The only geological evidence obtained during the course of the Discovery investigations relates to the South Sandwich Islands. During our running survey of the group in March 1930 some rock specimens were collected from Beach Point, Thule Island, by Dr E. H. Marshall and Mr T. J. Hart. These have been carefully examined and analysed by Tyrrell,[5] who pronounces them to be of a definite Andean type.

Our soundings show very definitely that in many places there are concentric submarine ridges which may in themselves be considered as favourable geological evidence of an Andean loop. All the sections drawn across the various sectors of the ridge show this peculiarity, though it is much more marked in the South Sandwich—South Orkneys and the South Orkneys—Clarence Island sectors, as well as across the South Sandwich Deep. Between the Burdwood Bank and the Shag Rocks the section (Fig. 3 *b*, p. 226), drawn approximately down the 49th meridian, shows numerous rises; but between the

[1] *Loc. cit.*, pp. 104–17.

[2] Wilckens, *Naturw. Abt. Niederrhein. Ges. Nat. Heilkunde*, 1930–31, pp. 1–14, Bonn (1932).

[3] Staub, *Die Bewegungsmechanismus der Erde*, Berlin.

[4] Pratje, Beiträge zur Bodengestaltung des Südatlantischen Ozeans. *Cent. f. Min.*, Abt. B, p. 132 (1928).

[5] Kemp and Nelson, The South Sandwich Islands, with a report on rock specimens by G. W. Tyrrell, *Discovery Reports*, III, pp. 191–7 (1931).

Shag Rocks and South Georgia the soundings indicate a connexion which is single for the greater part of its length, a double ridge being as yet demonstrated for a few miles only at the point where the section Fig. 2 *b* runs across. From South Georgia to the South Sandwich Islands the section (Fig. 2 *a*) shows little evidence of a connexion, but, as will be shown later, the influence of the South Sandwich Deep begins to be noticeable not far from the Clerke Rocks. In the South Sandwich Group itself we have the most pronounced example of ridging in the whole arc. Here there are two comparatively shallow submarine ridges, with an average depth of water of about 2000 m., separated by a very narrow deep with soundings of over 8000 m. It is of great interest to note that the existence of this deep was forecast many years previously by Suess[1] as follows: "Immediately to the east of the South Sandwich islands no soundings have been made. We might, perhaps, expect to find a foredeep there similar to that which occurs outside a part of the Antilles".

The discovery of the South Sandwich Deep by the 'Meteor', in 1926, when running their fifth profile eastwards along the 55th parallel of south latitude, confirmed this theory of Suess. Although their line of soundings only crossed the Deep at its extreme northern end, their conjecture that it extends right down the eastern side of the South Sandwich Group has proved correct, at any rate in part. In November 1930, while the 'Discovery II' was on passage from Cape Town to South Georgia via the ice-edge, we were able to confirm the Meteor's observations. We were unable, however, to obtain as deep an echo sounding as the 'Meteor' at this point, although we took a number of soundings over a considerable area. The Meteor's deepest echo sounding in this area is now given in their latest report[2] as 8264 m., the original echo distance of 8060 m. given in an earlier publication[3] having apparently been corrected, using a velocity of sound in sea water of 1517 m. per second. The deepest sounding obtained by the 'Discovery II' in this area was 7977 m., and the velocity of sound in sea water used for the correction of the depth was 1515·7 m. per second. The table of velocities of sound (see p. 236) used in the correction of all the echo soundings taken by the 'Discovery II' in the South Sandwich Deep and adjacent waters was compiled in accordance with the instructions contained in the Admiralty tables of the velocity of sound in sea water. The hydrological observations necessary for this work were made at St. 471 in 54° 57′ S, 27° 59½′ W, when water samples and temperatures were obtained to a depth of 7250 m. Actually this table varied very little from Table 23 in the Admiralty handbook as far as the latter went; its great value was in providing velocities of sound below 5000 m. without having to resort to extrapolation, which might have introduced errors.

In the latter half of February 1931, two more lines of echo soundings were taken by the 'Discovery II' in the area of the South Sandwich Deep. The first crossed the line of the islands in about 57° S, approximately midway between the Candlemas Islands and Saunders Island. These islands lie about 45 miles apart, the greatest distance between

[1] Suess, *loc. cit.*, *supra*, p. 496.

[2] *Wiss. Ergebn. Deutsch. Atlant. Exped.* '*Meteor*', I, pp. 183–4.

[3] Spiess, *Das Meteorfahrte*, p. 336, Berlin.

adjacent islands in the group, and one of the main reasons for crossing here was the lack of soundings between them. We had obtained a few soundings between the remaining islands during the 1930 survey, although at that time the oceanic echo-sounding machine was not giving the excellent results obtained in the following season. These soundings, however, were sufficient to show that the remaining islands are almost certainly connected by a submarine ridge, so that if there were any discontinuity, it could only be found here. As will be seen from Fig 4 *a*, which is a section of the Scotia Sea from west to east, this 1931 line of soundings shows a gradual rise from the west towards the connecting ridge between Saunders Island and the Candlemas Islands, the shallowest sounding being 2185 m. On the eastern side of the group there is a very sharp drop to 8000 m. in the Deep. We continued this line of soundings along the 57th parallel of latitude to approximately 23° W longitude. At this point we turned back and ran our second line in a north-westerly direction, crossing the line of the islands again some 40 miles north of Zavodovski Island in about 28° W longitude. Both these traverses confirmed the existence of the Deep as a very narrow trench, with a width of about 20 miles at the deepest part and having very steep sides below the 5000 m. level. While carrying out this examination of the Deep in 1931 we were unfortunate in having unsuitable weather for echo sounding; it was almost always necessary to stop for soundings over 4000 m. and water noises made it difficult to hear the echo from over 7000 m. We were able, however, to get thirty-eight soundings over 6000 m. on the two lines, and these in conjunction with the echo soundings taken at the northern end of the Deep in 1930 gave us altogether forty-three soundings over 6000 m. Of these, twenty-seven were over 7000 m. and two over 8000 m., the deepest sounding being 8102 m. on the north-westerly profile in a position approximately 56° 33 S, 24° 33′ W (see Chart 4).

The northern end of the South Sandwich Deep can be traced by means of the 5000 m. contour, to a position about 50 miles east of the Clerke Rocks. Several of the soundings which determine this contour were taken by the 'Deutschland' in 1911–12 and the 'Meteor' in 1926. All the remaining soundings have been obtained by the ships of the Discovery Committee and are mainly echo soundings from the 'Discovery II'. The southern end of the South Sandwich Deep, south of latitude 57°, still remains to be determined, but during the season 1931–2 the 'Discovery II' obtained soundings of over 5000 m. east and south-east of the southern extremity of the South Sandwich Group, and it is possible that these may represent the limits of the Deep in this direction.

It is of interest to note here that a preliminary comparison of a few of our results in this area with those of the 'Meteor', has already been made by Stocks.[1] The 'Discovery' results are shown in the form of a contoured chart of the South Georgia—South Sandwich area, which gives the position of the soundings but no actual depths, and a section drawn across the South Sandwich Deep. Stocks uses the uncorrected (unreduzierte Werte) soundings of the 'Meteor' and assumes that the echo soundings of the 'Discovery II' are also uncorrected. As already explained, however, all the 'Discovery II' echo soundings have been fully corrected. Stocks noted that the Deep extended to a position farther west than the 'Meteor's' observations would tend to show, and pointed out the bearing of the new facts on Suess' theory. A bathymetric chart of the Antarctic and sub-Antarctic areas embodying these results was published by the American Geographical Society in 1929.[1] This chart shows the South Sandwich Deep, and although on a very small scale, gives an accurate representation of the bathymetric conditions in the Scotia Sea as then known.

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[1] Stocks, *Zeit. Ges. Erdk. Berlin*, pp. 299 *et seq.* (1931).

Since this report was written, Stocks has published another brief paper (Der Südantillen-Bogen im Lichte neurerer Erkundungen, *Zeit. Ges. Erdk. Berlin*, 1932, Nr. 5/6) on the South Antillean Arc, which appears to be based very largely on soundings taken by the vessels of the Discovery Committee, and recently published in the Admiralty charts for the area. In this paper, which has perhaps been hastily written, the following conclusions, which are not borne out by our recent work, are advanced:

(i) It is stated that soundings show that the probable continuation of the Patagonian Shelf towards South

DETAILED ANALYSIS OF THE VARIOUS SECTORS OF THE SCOTIA ARC

TIERRA DEL FUEGO TO THE SHAG ROCKS

(Plate XLV, Charts 1, 2, 3)

It is now generally accepted that if the Andes are continued on towards South Georgia the continuation must lie through the Burdwood Bank, and our soundings are in definite support of this theory. A distance of 500 miles separates the eastern end of the Burdwood Bank from the Shag Rocks, and it will be seen from the bathymetric chart of the Scotia Sea (Plate XLV) that a well-defined submarine ridge can be traced by means of the 2000 and the 3000 m. contours for nearly the whole distance. There appears to be a break of approximately 60 miles from about 47° W to about 49° W, but further soundings to the north of the line on which the present contours are based may show that the ridge is continuous. The ridge is much more sharply defined to the west of this gap, there being two well-marked areas where the soundings are considerably under 1000 m. The minimum sounding in the largest of these areas was 368 m. in a position approximately 53° 55′ S, 52° 25′ W and in the other area, 594 m. in approximately 53° 28′ S, 49° 51′ W.

Georgia is through the Falkland Islands, whereas an examination of the contours in Plate XLV of this report will show that the shelf is definitely continued through the eastern end of the Burdwood Bank.

(ii) In the bathymetric chart (Fig. 36) given by Stocks, a long ridge, parallel to the main arc, is shown as extending from a point north of South Georgia to approximately 300 miles east of the South Sandwich Islands. The depth of water on the ridge is shown as under 3000 m. The evidence for the existence of this ridge appears to be very slender, for apart from the bank shown to the north of Cape Crewe, South Georgia, only two other soundings are mentioned. One of these is a Lucas depth of 2744 m. obtained by the R.R.S. 'Discovery' in February 1926, in a position 51° 55′ S, 32° 27½′ W, the other is an echo sounding of 1800 m. obtained by the 'Meteor' in the same month to the east of the South Sandwich Deep. From our bathymetric plate (Plate XLV) it will be seen that subsequent soundings leave no doubt as to the non-existence of this ridge.

(iii) North of the South Orkney Islands Stocks has shown another ridge, parallel to the main one, the existence of which is not supported by the recent lines of echo soundings obtained by the 'Discovery II'.

[1] Bathymetric map of the Antarctic (South Atlantic, Indian and Pacific Oceans) compiled by the American Geographical Society of New York, 1929.

These depths were obtained on a zig-zag line of soundings run in March 1931 from the eastern end of the Burdwood Bank to the Shag Rocks. During this traverse fifty-three soundings of under 2000 m. were obtained, and of these, four were under 500 m., nineteen under 1000 m., and forty under 1500 m. A subsequent line of echo soundings during the season 1931–2, running from south to north across this line in about 54° W, gave six more soundings under 2000 m., one of which was under 1500 m. This line crossed the earlier line in about 54° S, where the soundings were in close agreement, and continued north to 53° S. From here the line was run in a north-easterly direction to approximately 51° 30′ S, 49° 00′ W, where the course was altered to south.

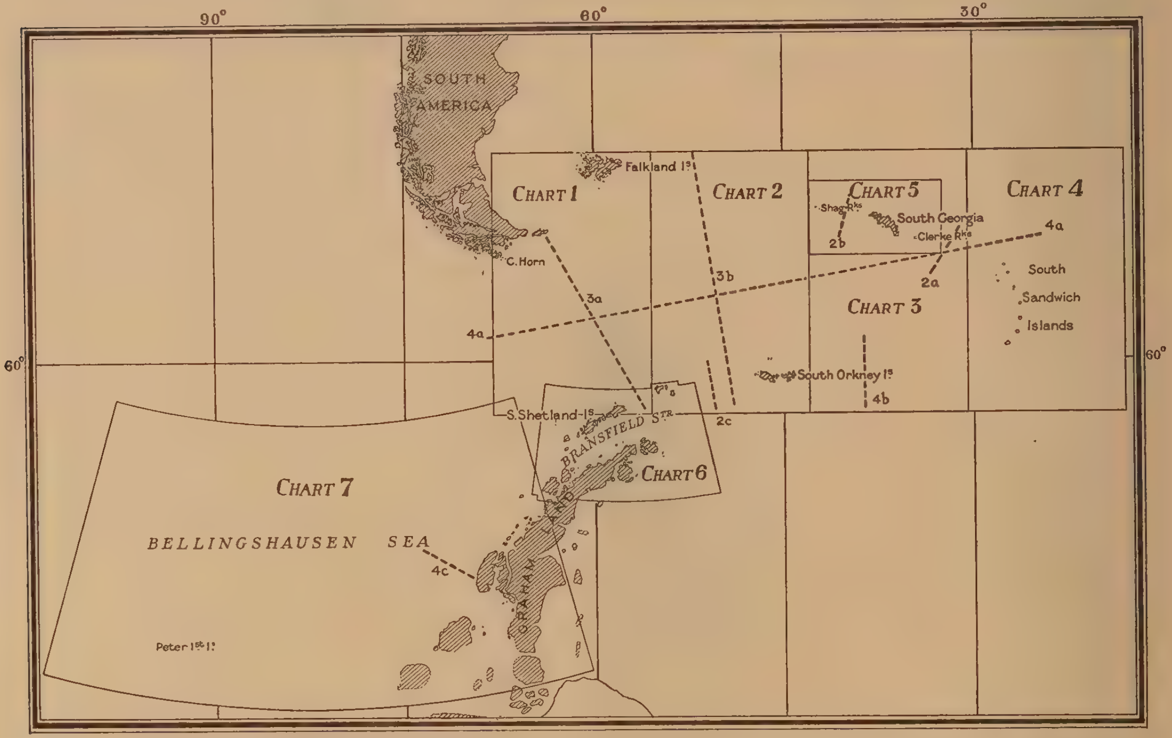
90°
60°
30°
60°
60°
SOUTH AMERICA
Falkland Is
CHART 1
CHART 2
CHART 5
CHART 4
Shag Rks
South Georgia
Clerke Rks
2b
4a
2a
C. Horn
3b
3a
CHART 3
South Sandwich Islands
4a
South Orkney Is
4b
S. Shetland Is
BRANSFIELD STR
2c
CHART 6
CHART 7
BELLINGSHAUSEN SEA
4c
GRAHAM LAND
Peter Ist I.

Fig. 1. Key chart showing the areas covered by Charts 1–7, and positions of sections in Figs. 2–4.

This southerly traverse along the 49th meridian crossed two of our earlier lines of soundings, the first in about 53° 20′ S, and the second in about 54° 30′ S. Unfortunately about 10 miles north of the former line the oceanic echo-sounding machine broke down and soundings were not resumed for about 30 miles, so that the confirmation of the depths recorded in the previous year was not possible. On the second line, however, the agreement was good.

Fig. 3 *b* (p. 226) shows a section across the Scotia Sea which is based on this line of soundings. From it can be seen very clearly both the Tierra del Fuego—Shag Rocks ridge and also the connexion, double at this point, between the South Orkneys and Clarence Island.

From 47° W to the Shag Rocks many more soundings are necessary before the contours can be drawn in accurately, but from the soundings now available it will be seen that there can be no doubt as to the existence of a ridge.

Previous bathymetric charts of this area have shown the Rhine Bank in a position approximately 55° 30′ S, 53° 30′ W with a depth of 121 m. In January 1926 the 'Meteor' searched unsuccessfully for the Bank,[1] obtaining a sounding of 3640 m. very close to the charted position, and in the course of the season 1931–2 the 'Discovery II' passed between the Rhine Bank and the Burdwood Bank, obtaining soundings of 2500–3000 m. within 25 miles of the former. In view of this recent evidence the Rhine Bank has been omitted both from our sounding and bathymetric charts.

SOUTH GEORGIA AND THE SHAG ROCKS

(Plates XLV, XLVI, Charts 3, 5)

The chart of South Georgia and the Shag Rocks (No. 5) shows the majority of the soundings obtained during the Discovery investigations since February 1925. They number approximately 1600 and have mostly been taken by the echo method. Certain inshore soundings taken in the bays and harbours during Lt.-Cmdr. Chaplin's survey[2] have been omitted, as the scale of the chart is too small to insert more than a very small proportion. The bathymetric chart (Plate XLVI) is based mainly on the 1600 soundings, although account has been taken of all other available soundings, especially those of the 'Quest' and 'Meteor'. These and other soundings not obtained during the Discovery investigations are shown on the bathymetric charts by circles as opposed to the black dots which represent our soundings.

Nearly all these soundings round South Georgia and two of the lines between Willis Island and the Shag Rocks were obtained during the various plankton surveys. During these surveys lines of stations are worked out to a distance of 100–120 miles from the land, starting from various points round the island. By coming back diagonally from the outer end of one line to the shore end of the next and by changing the starting-points and the angles of the lines with the land, it has been possible to cover a considerable amount of ground. It was also usual when proceeding to and from South Georgia to set a slightly different course on each occasion, which accounts for the greater number of soundings obtained on the northern side of the island.

As a result of the survey work carried out between 1926 and 1930 by Lt.-Cmdr. Chaplin, R.N., and the running surveys made by Lieut. Nelson, R.N.R., in 1931, considerable alterations have been made in the charted coast-line of the island, and as a result of this work it has been necessary to omit as unreliable certain soundings which were fixed by land bearings. With regard to the bathymetric chart, soundings from other sources which are known to have been fixed from the land have been adjusted to the new outline of the land as far as possible and doubtful ones have again been omitted.

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[1] *Wiss. Ergebn. Deutsch. Atlant. Exped. 'Meteor'*, I, p. 175.

[2] Lt.-Cmdr. Chaplin, R.N. Narrative of Hydrographic Survey Operations in South Georgia and the South Shetland Islands, 1926–30, *Discovery Reports*, III, pp. 297–344, Pls. XL–XLIV, Charts 1–4 (1932).

From the bathymetric chart of South Georgia and the Shag Rocks (Plate XLVI) it will be seen that the coastal shelf of South Georgia has a considerable extent, the average distance of the 500 m. contour from the coast being about 25 miles on the south-west side of the island. This distance varies considerably, there being one point south-west of Cape Disappointment where the 500 m. contour is only about 16 miles from the land and another west-south-west of Annenkov Island where the shelf runs out for nearly 60 miles, and then falls away rapidly, the soundings increasing from 500 to 3000 m. in about 15 miles. This sharp drop from the coastal shelf to oceanic depths appears to be a characteristic feature of South Georgia, and, in conjunction with the numerous soundings obtained up to the present, can be a valuable aid to navigation in thick weather for any ship fitted for deep-water echo sounding.

It has already been stated in the general discussion on the Scotia Arc that in view of its geological structure, South Georgia appears to be one of the weakest links in the chain of islands and submarine ridges constituting the arc, and that some have maintained that an arcuate connexion lying north or south of the island is more probable. The numerous echo soundings round South Georgia do not bear out this theory. On the northern side of the island a small bank has been found about 80 miles north of Cape Crewe which has an average depth of water of about 1800 m., but it is only a few square miles in extent and existing soundings do not show any trace of it to the east or west. On the southern side of the island the concentration of soundings is not so great, but there is sufficient evidence to prove that no submarine ridge parallel to South Georgia exists on this side of the island.

Influenced, probably, by this theory, those who have drawn bathymetric charts or maps of the Scotia Sea and surrounding areas have hitherto shown the Shag Rocks, which lie about 130 miles east of Willis Island, as an isolated group apparently rising quite sharply from the ocean bed. The depth of water usually shown between the Shag Rocks and South Georgia is 3000–4000 m. In all except Pratje's contour map, where the soundings on which the contours are based are not shown, there appears to be only one sounding to support the theory of an isolated group. This is a sounding of 3380 m. obtained by the 'Antarctic' in a position slightly north of the direct line between Willis Island and the Shag Rocks. With regard to the geological evidence there is no record of any specimens having been obtained from the Shag Rocks, we therefore have to rely entirely on soundings to prove the connexion with South Georgia.

In April 1929 the 'William Scoresby' obtained a Lucas sounding of 232 m. on a rock bottom at St. WS 427, almost exactly half-way between Willis Island and the Shag Rocks, and in March 1930 at St. WS 525 and WS 526, two more wire soundings of 159 and 1545 m. respectively on approximately the same line. These soundings indicated the probability of a connecting ridge, and between December 1930 and April 1931 the 'Discovery II' was able to obtain four lines of echo soundings in the area. About 320 soundings were taken and of these about 50 were in the vicinity of the Shag Rocks and a small outlying rock about 10 miles to the south-west of the main group.

The four lines of soundings have definitely established the existence of a connecting

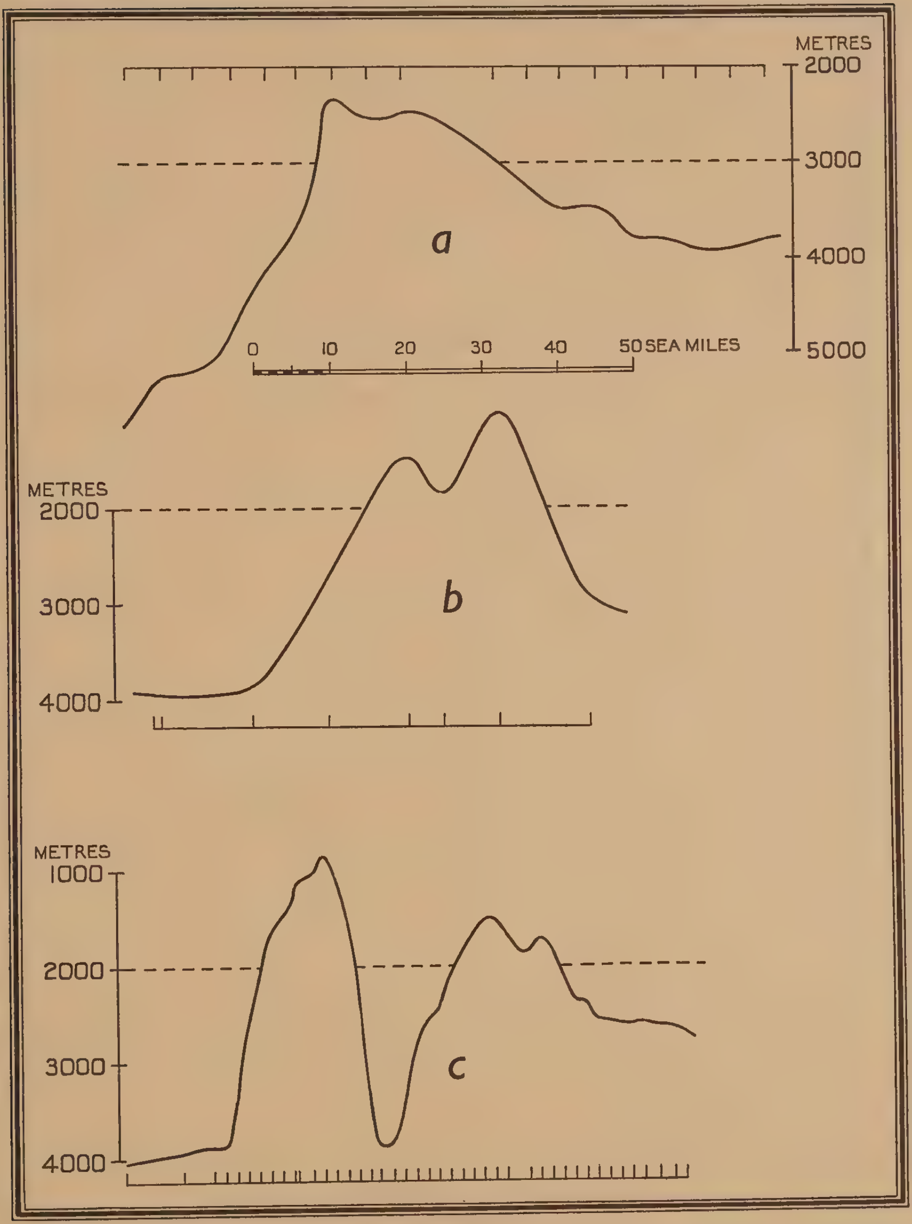

Fig. 2.

a. Section from north-east to south-west between South Georgia and the South Sandwich Group: based on 18 soundings made between 55° 05′ S, 32° 26′ W and 56° 01′ S, 34° 13′ W.

b. Section from north to south between the Shag Rocks and South Georgia: based on 8 soundings made between 53° 13′ S, 39° 53′ W and 54° 10′ S, 40° 02′ W.

c. Section from north to south between the South Orkneys and Clarence Island: based on 43 soundings made between 59° 49′ S, 49° 24′ W and 61° 00½′ S, 49° 48′ W.

Vertical scale of all three sections exaggerated 24 times.

ridge with a maximum depth of water of under 2000 m. and an average depth of approximately 1300 m. Two further lines of echo soundings were taken to the north of the ridge by the 'Discovery II' during the season 1931–2, and these have been of considerable value in determining the 4000 m. contour. This contour is of great importance in this area, as it marks the return, on the northern side of the ridge, to the average depth of this part of the South Atlantic.

The depth of water on the ridge gradually increases from South Georgia towards the Shag Rocks till it reaches a maximum of 1650 m. about 55 miles from Willis Island. The depth for the next 35 miles shows a certain amount of variation from the average, a sounding of 997 m. occurring at a point a few miles due south of the 'William Scoresby's' original depth of 232 m. Farther on the bottom rises sharply from 1236 to 459 m. in less than 4 miles, and for the remaining distance to the Shag Rocks the average depth of water is about 150 m.

The shelf surrounding the Shag Rocks appears to extend for a considerable distance. Thirty miles to the south the soundings at present available show a depth of 1100 m., and in a northerly direction the depth only reaches 2000 m. some 35 miles from the Rocks.

SOUTH GEORGIA TO THE SOUTH SANDWICH ISLANDS

(Plates XLV, XLVI, Charts 3, 4, 5)

The connexion between South Georgia and the Clerke Rocks, which lie about 40 miles east-south-east of the south-eastern point of South Georgia, is quite definitely shown by the existing soundings, the average depth of water between the Rocks and South Georgia being from 100 to 130 m. (Chart 5). According to Holtedahl,[1] the Clerke Rocks are of considerable geological interest, as one of the specimens which he obtained from there in 1928, and which is reported to occur as veins in the granite, is said to represent a basic dyke. A detailed examination of this specimen has yet to be made. In conclusion, Holtedahl says of the Clerke Rocks that "the find of an originally deep-seated rock, cut by dykes, not very far from the intrusive masses of South Georgia, and in the direction towards the volcanic ridge of the South Sandwich Islands is of considerable interest".

From the Clerke Rocks to the South Sandwich Islands, a distance of about 280 miles, the connecting ridge is not very clearly defined at the moment. There is, however, sufficient evidence from the soundings to show that a connexion can be traced. Fig. 2 *a*, which is based on a line of echo soundings from north to south across the ridge, and Fig. 4 *a*, which is a section crossing the ridge farther to the east and at a different angle, both show that there is a gradual rise from the bottom of the Scotia Sea basin, followed by a sharp drop into the north-western end of the South Sandwich Deep. The rise on the southern side varies between 400 and 700 m. and the depth of water on the ridge averages about 2700 m. The minimum sounding found was 1935 m. in approximately

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[1] Holtedahl, *loc. cit., supra*, p. 102.

55° 28′ S, 31° 47′ W. On the northern side the 4000 m. contour clearly shows that the influence of the South Sandwich Deep can be traced to a position about 40 miles north-north-east of the Clerke Rocks. Fig. 2 *a* shows a section taken across the ridge into this part of the Deep and Fig. 4 *a* shows a section farther to the east, crossing the Deep at an oblique angle.

From the trend of the 1000 and 2000 m. contours to the south-east of the Clerke Rocks and to the north-west of Zavodovski Island it is probable that soundings taken along a line about 10 or 15 miles south of the existing intensive lines of soundings will show that the crest of the connecting ridge lies to the south of where it is now placed on the sections and bathymetric chart. The data now available show the possibility of two gaps in about 29° 30′ W and 31° W.

The 'Meteor' ran a line of echo soundings across this ridge during February 1926, starting from about 56° 30′ S, 31° 00′ W and proceeding in a north-easterly direction. From these soundings evidence was obtained that there was a double ridge at this point, the separate peaks having approximately the same depth of water of 2400 m.[1] This depth is slightly less than the average found by the Discovery Investigations, but without more detailed information as to the position of these soundings they cannot be compared with our interpretation of the bottom relief. It seems probable, however, that they lie to the south of our lines. Pratje, in his bathymetric map, does not show any indication of this shoaling between South Georgia and the South Sandwich Islands, but his contours, like ours, are drawn at 1000 m. intervals. With the data at present available it appears that no intermediate contour will show the existence of a continuous connexion, and that in this section of the arc the depth of water on the ridge may be only 400–700 m. less than the average of that at the eastern end of the Scotia Sea.

SOUTH SANDWICH ISLANDS TO SOUTH ORKNEY ISLANDS

(Plate XLV, Charts 3, 4)

The ridge connecting the various islands of the South Sandwich Group has already been discussed during the description of the South Sandwich Deep, so that the next section of the arc to be considered is from Southern Thule, in the above group, to the South Orkney Islands. Here we have been unfortunate each season with regard to ice conditions, and it was not till early in 1932 that the 'Discovery II' was able to obtain a line of echo soundings which crossed the ridge from south to north in about 36° W. This line is within 40 miles of the line of soundings taken by the 'Deutschland' in 1912,[2] and examination of the contours will show that these observations have been confirmed. The minimum sounding found by the 'Discovery II' was 543 m. in approximately 60° 20′ S, 36° 03′ W, and the section based on this line (Fig. 4 *b*) shows that the main ridge is roughly 60 miles wide at this point with an average depth of water of about 1000 m. To the south a narrow trench over 4000 m. deep is found, followed by a

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[1] *Wiss. Ergebn. Deutsch. Atlant. Exped.* '*Meteor*', 1, p. 183. See also Stocks, *loc. cit.*, *supra*.

[2] Brennecke, *Arch. Deutsch. Seewarte*, XXXIX, Nr. 1, tafel 2 (1921).

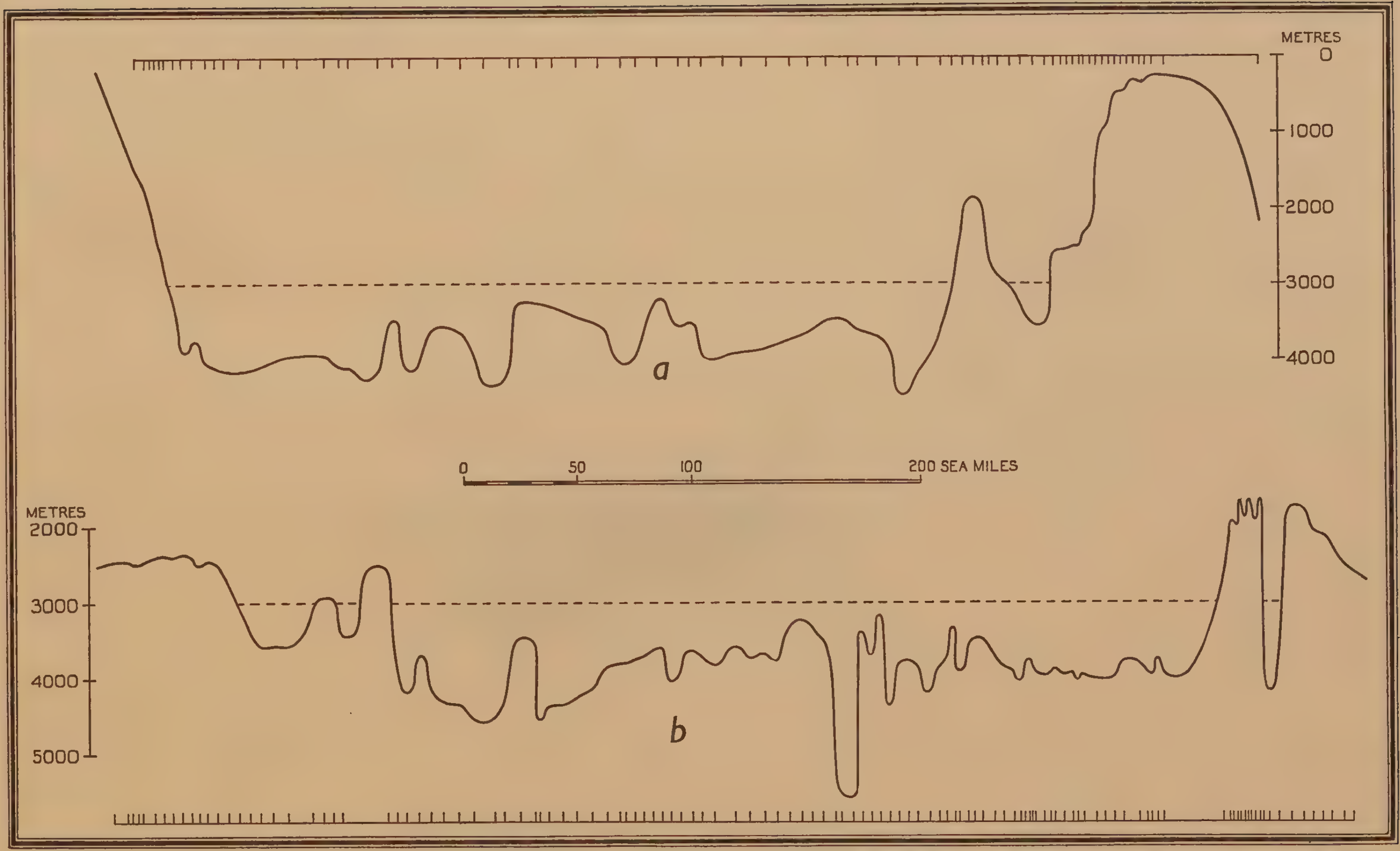

Fig. 3.

a. Section from north to south across Drake Passage: based on 79 soundings taken between Staten Island and 62° 00′ S, 56° 00′ W.

b. Section from north to south across the Scotia Sea: based on 122 soundings taken between 51° 28′ S, 49° 18′ W and 60° 50′ S, 48° 19′ W.

Vertical scale exaggerated 63 times.

smaller but well-marked ridge where the soundings average about 3000 m. This in turn is succeeded by a deeper trench with soundings over 5600 m. Comparison with the Deutschland soundings shows that they also found a double ridge, their minimum soundings being 1050 and 1012 m., with a deep trench of over 5000 m., lying to the south. These deep soundings following a ridge show a great similarity to the conditions prevailing in the neighbourhood of the South Sandwich Islands, and it seems possible that the Deep extends round outside this sector of the arc.

About half-way between the Discovery II line of soundings and Southern Thule the British Admiralty chart[1] shows three soundings under 2000 m. Two of these, 1079 and 1158 m., were obtained by the 'Scotia' between 1902 and 1904, the other of 1862 m. was taken by the 'Deutschland' on her journey south to the Weddell Sea in 1911. These depths compare very closely with those taken to the westward, and may be regarded as evidence in favour of a connecting ridge.

Between the line of Deutschland soundings in 37° W and the South Orkneys there are also only a few soundings. These were taken by the 'Scotia' between 1902 and 1904 and show that the 500 m. contour extends to a point 75 miles east of the islands. The extension of the coastal shelf so far to the east is strong evidence in favour of a Southern Thule—South Orkney ridge. It is hoped to obtain more soundings in this area in the near future.

SOUTH ORKNEY ISLANDS TO CLARENCE ISLAND

(Plate XLV, Chart 2)

Although geologically the South Orkneys do not appear to support the theory of an arc owing to the apparent lack of any true Andean type of rock, it has been shown by soundings that to the east there is a strong probability of a connexion between them and the South Sandwich Group. On the western side of the South Orkneys the probable existence of a submarine ridge was brought to our notice by two soundings obtained in the 'Discovery' while working St. 169 in February 1927. Here a Lucas sounding of 2514 m. was obtained in a position 60° 48′ 50″ S, 51° 00′ 20″ W. After the station a deep net was towed, but it fouled the bottom after a few miles and a second sounding gave a depth of 1849 m. in a position approximately 5 miles to the west of the other. This station was worked alongside a very large tabular berg, which, from our observations, appeared to be aground.

From this date until the season 1930–1 no more soundings were obtained from this area, but in this season the complete absence of pack-ice from these waters enabled us to obtain numerous echo soundings. These have been considerably amplified during the season 1931–2, and there can be no doubt that a submarine ridge with a depth of water of under 2000 m. connects the South Orkneys and Clarence Island. The average sounding is from 1600 to 1700 m., and it appears fairly certain that a double ridge is to be found over practically the whole distance. The secondary ridge, which lies to the north of the

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[1] British Admiralty Chart, 2202 *b*.

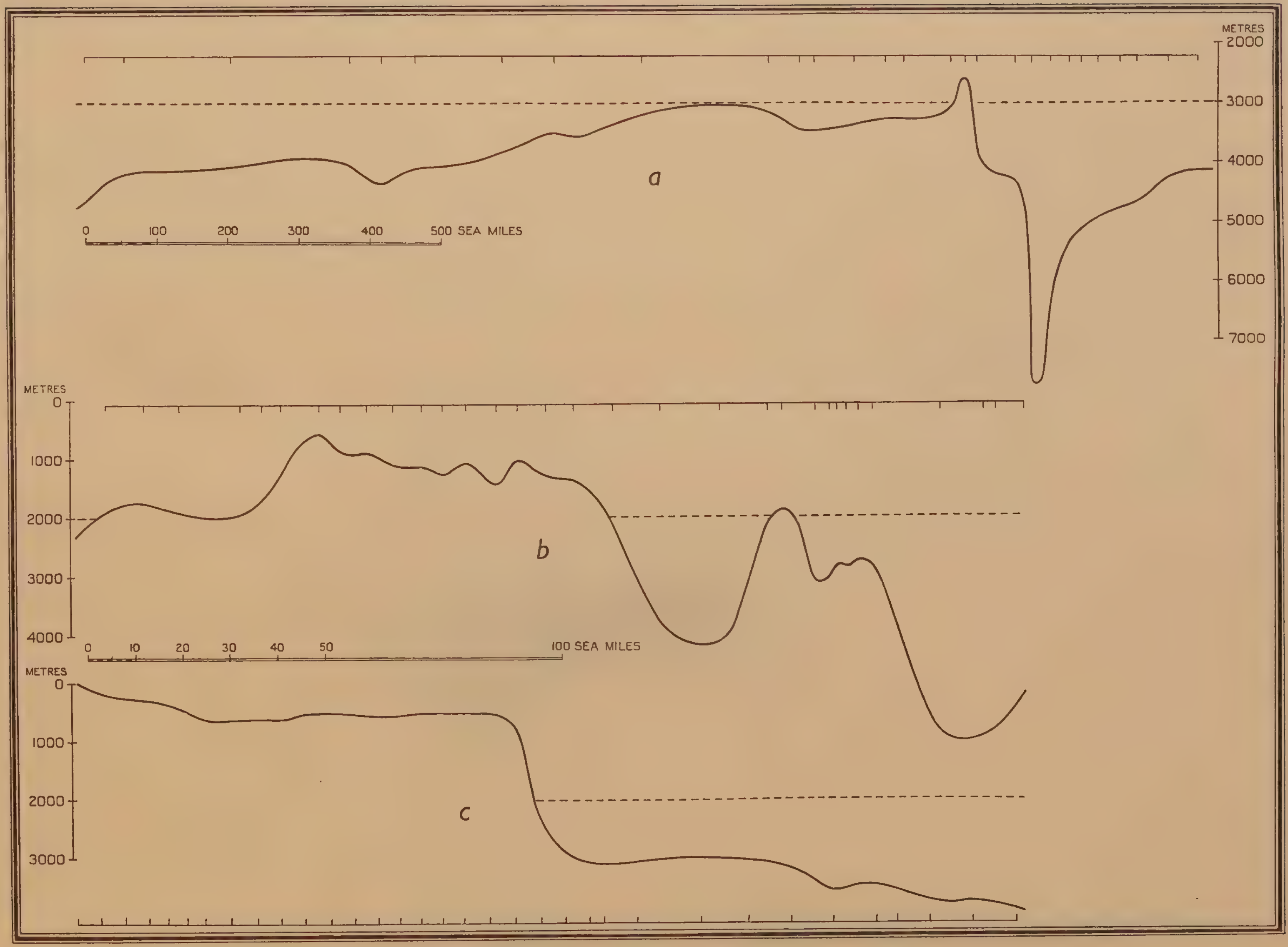

Fig. 4.

a. Section from west to east across the Scotia Sea and South Sandwich Deep: based on 29 soundings taken between 57° 30′ S, 67° 00′ W and 53° 30′ S, 22° 00′ W.

b. Section from north to south between Southern Thule (South Sandwich Group) and the South Orkneys: based on 32 soundings taken between 57° 54′ S, 36° 11′ W and 61° 24′ S, 36° 03′ W.

c. Section running approximately north-west from Mt. Gaudry, Adelaide Island, Bellingshausen Sea to 65° 00′ S, 74° 05′ W: based on 32 soundings. The lower scale of miles applies to both *b* and *c*. Vertical scale in *a* exaggerated 155 times, in *b* and *c* 24 times.

main connecting ridge, is the more pronounced, having a depth of water in one place of only 487 m. (60° 11′ S, 50° 28′ W approx.) and in another of 501 m. (60° 15′ S, 51° 50′ W approx.). The main ridge is quite well defined, but the least depths over the corresponding portions are 1501 m. in 60° 25′ S, 48° 43′ W, and 1523 m. in 60° 37′ S, 49° 40′ W (both positions approximate). Fig. 2 *c*, which is based on a line of echo soundings run in December 1930 from north to south across the ridge in approximately 49° 40′ W, shows the double ridge very clearly. Fig. 3 *b*, which is based on a line of soundings across the Scotia Sea in 1932, shows a section across the ridge in approximately 48° 20′ W, where the formation appears to be the same. This double ridge fades away in about 51° 40′ W, from which point a broad shallow ridge continues to Clarence Island. The depth of water between the ridges is about 3000 m., but at one point there is an abrupt descent, apparently of about 45°, to 5000 m. at which depth a trench also occurs between the eastern end of the secondary ridge and the South Orkneys.

Hydrological observations made in 1930 on each side of the supposed line of the ridge gave valuable confirmation of the theory of a connexion. It was found that entirely dissimilar conditions, both of temperature and salinity, existed on the two sides, and that these conditions were such as could only have been caused by a submarine ridge of considerable height interrupting the free interchange of water between the Weddell Sea and Scotia Sea.

This section of the arc from the South Orkneys to Clarence Island may be termed the last oceanic sector, as over the remaining distance from Elephant Island to the South Shetlands comparatively shallow depths are to be found. These will be considered in the remarks on the bottom relief of the Bransfield Strait and the waters adjacent to the South Shetlands.

SOUNDINGS IN OTHER LOCALITIES

SOUTH SHETLAND ISLANDS AND ADJACENT WATERS

(Plate XLVII, Chart 6)

The Bransfield Strait, which lies between the South Shetlands and Trinity Peninsula, and the area east of it as far as Elephant and Clarence Islands, have been extensively sounded out. The total number of soundings on which our bathymetric chart (Plate XLVII) is based is about 1500, of which number approximately 1400 were taken in the 'Discovery II' by the echo method. The remainder consist of a line of echo soundings taken by the 'Meteor' during her visit to Deception Island in January 1926,[1] and a few

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[1] These soundings appear to have been calculated from a constant speed of sound in sea water for all depths, i.e. 1490 m. per sec. (*Wiss. Ergebn. Deutsch. Atlant. Exped. 'Meteor'*, 1, Beilage XII), and by this method, if the Admiralty tables of the speed of sound in sea water for this area are accepted, soundings above 5000 m. will be too deep and those below this figure too shallow. In the bathymetric chart no attempt has been made to reduce these soundings to the speeds given in the Admiralty tables, as the differences are not sufficient to have any appreciable effect on the contours concerned.

Lucas soundings by the 'Discovery', 'William Scoresby', 'Pourquoi Pas?'[1] and 'Antarctic'.[2] The positions of soundings taken by the vessels of the Discovery Committee are shown in black—those of other vessels as circles. The combined results give a good general idea of the bottom relief of this area.

When considering the contours of the bathymetric chart (Plate XLVII) in detail, it will be seen that there are two separate depressions, a small one with a maximum depth of 1371 m. lying south of Snow Island, and the main depression which stretches from Deception Island almost to Clarence Island. The eastern end of the latter has a considerable area with a depth of over 2000 m., the maximum found by the 'Discovery II' being 2879 m., but the western end is on the whole much shallower. Here there is only one small area over 2000 m., with a maximum of 2085 m. found by the 'William Scoresby' in February 1929. The remainder of the depression has an average depth of 1500–1600 m.

The slope on the northern side of the main depression is fairly steep along the whole length, but on the northern side of the South Shetlands and the Shetlands—Elephant Island ridge the bottom falls away quite gently. This may be compared with the South Sandwich Islands ridge and the Deep beyond it, which has already been described, though the drop from the South Shetlands to the Bransfield depression is not so sharp and the depression not nearly so deep. Geologically, however, it would appear that both may have been formed in the same manner. Three lines of our echo soundings and one of the 'Meteor's' place the average distance of the 1000 m. contour about 40 miles from the centre line of the South Shetlands on the northern side and 10 miles on the southern.

More soundings are required in the depression in the neighbourhood of Bridgman Island in order to determine the position of the 1000 m. contour. Bridgman Island is certainly volcanic and is regarded by Holtedahl[3] as "the remains of a much larger volcanic mass which has been to a large extent planed down by marine abrasion". It seems probable, therefore, that it was once part of the South Shetlands and that there is comparatively shallow water between it and King George Island. There is only one sounding in the vicinity, 620 m., taken by the 'Pourquoi Pas?', and on this and on the geological evidence we think it probable that the 1000 m. contour lies to the south of the island. The position of Bridgman Island appears to be rather similar to that of Deception Island, between which and Livingston Island a submarine plateau exists.

Unfortunately there are only two lines of echo soundings running north and south between King George and Elephant Islands, but these, together with a Lucas sounding midway between them, show the probable existence of a ridge. Ferguson, who was unable to land on Elephant Island, has suggested[4] that some of the darker stratified rocks may be bedded lavas. This would appear to be an error, and Wordie,[5] who collected specimens there after the loss of the 'Endurance', has decided that the rocks, which were critically examined by Tyrrell, are metamorphic and probably altered volcanic ashes, but too metamorphosed to be properly identified. It would thus appear that although the soundings indicate the presence of a ridge, the structure of these islands themselves cannot be used as evidence of a former land connexion.

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[1] *Deux. Expéd. Fran.* (1908–10), Cartes, No. XI (1912).

[2] *Swed. Süd-Pol. Exped.* (1901–3), I, Lief 2, Karte (1917).

[3] Holtedahl, *loc. cit.*, *supra*, pp. 97–8.

[4] Ferguson, *Trans. Roy. Soc. Edin.*, LIII, p. 35 (1925).

[5] Wordie, Shackleton Antarctic Expedition, 1914–17, Geological Observations in the Weddell Sea Area, *Trans. Roy. Soc. Edin.*, LIII, p. 27 (1925).

Hydrological observations tend to show that the oceanic warm deep-water layer in Drake Passage, in which the maximum temperature is found at about 500–600 m., occurs in the Bransfield Strait with the maximum temperature at an average depth of 300 m. This difference of levels inside and outside the strait is accounted for by the rise of the ocean bed towards the South Shetlands which forces the south-flowing warm deep water upwards to a level where it can enter the strait. It is almost certain that it enters between Smith and Snow Islands, where the soundings show a channel with an average depth of 600–700 m. It then passes across the smaller basin in a south-easterly direction and enters the larger basin to the south of Deception Island. On the evidence of the present soundings there appears to be a ridge between Deception and Tower Islands, but the position of the 500 m. contour is a little uncertain, as it could also be drawn to run east and west showing a channel with a depth of 600 m. and over. Such a channel would allow the passage of the warm deep water. The characteristics of this layer gradually grow weaker towards the eastern end of the main basin, disappearing altogether south of Elephant Island. Hydrological observations in this area show that the chief water movement is an inflow of Antarctic surface water from the Weddell Sea.

In the vicinity of Joinville Island and to the north-east of it, the only soundings available are those taken by the 'Pourquoi Pas?' in 1908–10 and the 'Antarctic' in 1901–3. These, however, in conjunction with our zigzag line of echo soundings south of Clarence Island show that Trinity Peninsula is continued as a shallow submarine plateau towards the north-east and eventually joins up with the main Orkneys—Shetlands ridge. Here large icebergs from the Weddell Sea are frequently found stranded. It is hoped to obtain more soundings south of Clarence Island to clear up some doubtful points, one of which is the possible existence of a channel running east and west and shown at the moment only by a very few soundings. The hydrological evidence here is more against than for the existence of such a channel.

While the 'Discovery II' was on passage from Port Lockroy, Wiencke Island, to Deception Island by way of the De Gerlache Strait, continuous echo soundings were taken which showed that up the centre of the strait there was a channel with an average depth of between 600 and 700 m. Near Cape Murray, at the eastern end of the Strait, the soundings exceeded 1000 m. for several miles. Nine soundings of over 1000 m. were obtained, the maximum being 1141 m. On coming out of the strait we continued up towards Trinity Island, intending to pass through Orleans Channel, but owing to the presence of pack ice we were compelled to turn north before entering it. On this northward passage we discovered the existence of a reef to the west of Farewell Rock, Trinity Island. We passed between this reef and the island, the soundings shoaling gradually to 66 m. and falling away again quite sharply on the northern side.

The lines of echo soundings taken by the 'Discovery II' round the South Shetlands and in the Bransfield Strait were all run between December 19, 1930 and March 10, 1931. Altogether 12 days were occupied in taking 1432 echo soundings, which is a considerable advance on the number of wire soundings which could be taken in the same period. Only on one line, from Deception Island to the South Orkneys via Clarence Island, was it necessary to abandon echo soundings on account of weather conditions. Here we were forced to give up sounding over a distance of 70 miles by a north-west gale and a very lumpy sea, which made it impossible to manoeuvre the ship without causing excessive water noises in the hydrophone.

BELLINGSHAUSEN SEA

(Chart 7)

Until the season 1930–1 very few soundings had been recorded from the Bellingshausen Sea. Late in December 1930, the 'Discovery II' left Deception Island in an attempt to push as far south and west as possible. As will be seen from the sounding chart (No. 7) the trend of Graham Land was followed as far down as Adelaide Island. Here very heavy pack-ice was encountered and the ship had to strike north again for some considerable distance before further progress to the west was possible. From this time until the return to Adelaide Island some 12 days later the ship was either in pack-ice or skirting the edge of it. Several attempts were made to get south, but owing to the very heavy ice year it was not possible to get beyond 69° 49′ S in approximately 101° W. This was reached on January 6, 1931, and the echo sounding was 4131 m., about 100 m. less than the average depth for that part of the Bellingshausen Sea. It was in this vicinity that members of Cook's expedition were deceived by an appearance of land in January 1774. Forster, writing on Cook's voyage in the 'Resolution', says "we were amused with the appearance of land, for after standing on towards it for some hours, it vanished in clouds". Cook's position was then about 68° S and he stood on to 71° 10′ S without sighting land. In February 1930, the 'William Scoresby' obtained Lucas soundings of 574, 584 and 580 m., with a bottom of yellow mud farther to the east. These positions are about 120 miles west of Charcot Island, which is the nearest known land.

On the return passage of the 'Discovery II' from 101° W, it was found that although some of the pack had moved away to the north-east it was still not possible to reach Peter Ist Island, and we passed about 25 miles to the north of it. The soundings here showed little change from the average for this part, that taken nearest the island being 3981 m.

The average depth of the ocean bed in the Bellingshausen Sea varies very little. The general information gained from our soundings being that the depth lies approximately between 3900 and 4400 m., the maximum found by the 'Discovery II' being 4598 m. in about 68° 05′ S, 98° 20′ W. In the area over which our soundings were taken, the greater depths lie to the north and west of Peter Ist Island.

On our return we were able to reach Adelaide Island and three lines of soundings were taken over the edge of the continental shelf between Alexander Ist Island and the Biscoe Islands. These soundings show that the shelf extends some 80 miles from the former and about 65–70 miles from the latter. The great breadth of the continental shelf may presumably be taken as evidence of the antiquity of the land masses which lie to the south. From the section (Fig. 4 *c*), which is based on a line of 32 soundings run on a north-west bearing from Mt Gaudry, Adelaide Island, it will be seen that the edge of the continental shelf is very steep, the depth increasing from 500 to 3000 m. in 15 miles. A very similar slope occurs on the other two lines.

On these lines regular soundings over 4000 m. were not obtained until we were some 200–250 miles from the land, and it seems probable from this evidence and from the extent of the continental shelf that if the same conditions prevail farther to the west, the land must lie a considerable distance to the south of the highest latitudes reached by the 'William Scoresby' and 'Discovery II'.

Approximately 700 echo soundings were taken during the time spent in the Bellingshausen Sea and on the return trip to Port Lockroy, via the Biscoe Islands and the Pendleton Strait. Only about 650 of these soundings are inserted on the chart, as the scale is not sufficiently large to show those taken for navigational purposes when approaching and leaving the Marin Darbel Islands. The majority of the soundings were taken with the deep-water echo machine, and at times with considerable difficulty owing to the noise made by the pack-ice on the hull, which completely drowned the echo in the hydrophone. Another effect of pack-ice which we had anticipated did not, however, occur. It had been thought that the close proximity of pack-ice might cause both the hammer blow and the echo to be reflected from the undersides of the large floes, giving in the first case a false echo and in the other a re-echo of the true depth. We have also tried the effect of taking echo soundings in the vicinity of large icebergs, especially those which would have a draft of several hundred feet, as the under-water portion might be expected to reflect the sound waves from the hammer and cause false echoes. No interference was ever observed, and it seems probable that the water chamber under the hammer is effective in preventing the sound waves from scattering. On the other hand, re-echoes have been obtained on several occasions, but only in waters completely free from ice. One of these was recorded from the Orkney—Clarence Island ridge, where a faint but quite distinguishable re-echo was picked up at exactly double the scale reading of a sounding of 1344 m. These re-echoes were probably obtained on a clean rock bottom, and to this they may be due.

OTHER SOUNDING WORK

During the course of our work in the south, opportunity has always been taken, as conditions permitted, to search for various rocks or vigias which have been reported from time to time from the South Atlantic and Southern Oceans. Most of them have been reported, on single occasions only, as isolated rocks in mid-ocean, and we have not been able to find any of those for which we have searched despite care and extensive echo sounding. It seems most likely in the light of our experience that small bergs of "black" or "bottle-green" ice have been mistaken for rocks, for these bergs, which are not uncommon off the mouth of the Weddell Sea, are very confusing, especially in thick weather or a bad light. Several of those sighted from the "Discovery II' might easily be mistaken for a small rock awash, had it not been for the knowledge that the echo soundings at that moment were well over 3000 m.

The most interesting search we carried out was for Thompson Island which was supposed to lie to the north-eastward of Bouvet Island. This island was first reported by Captain Norris of the whaler 'Sprightly' in 1825 as being approximately 45 miles north-east of Bouvet Island. Some rocks, called the Chimneys, were reported at the same time to lie about 4½ miles to the south-eastward of Thompson Island. From 1825 until 1893 no one appears to have sighted the island, but in the latter year Captain Fuller of the 'Francis Allen' is stated to have sighted it but to have been unable to fix its position on account of wind, ice and fog. Since then it has been unsuccessfully searched

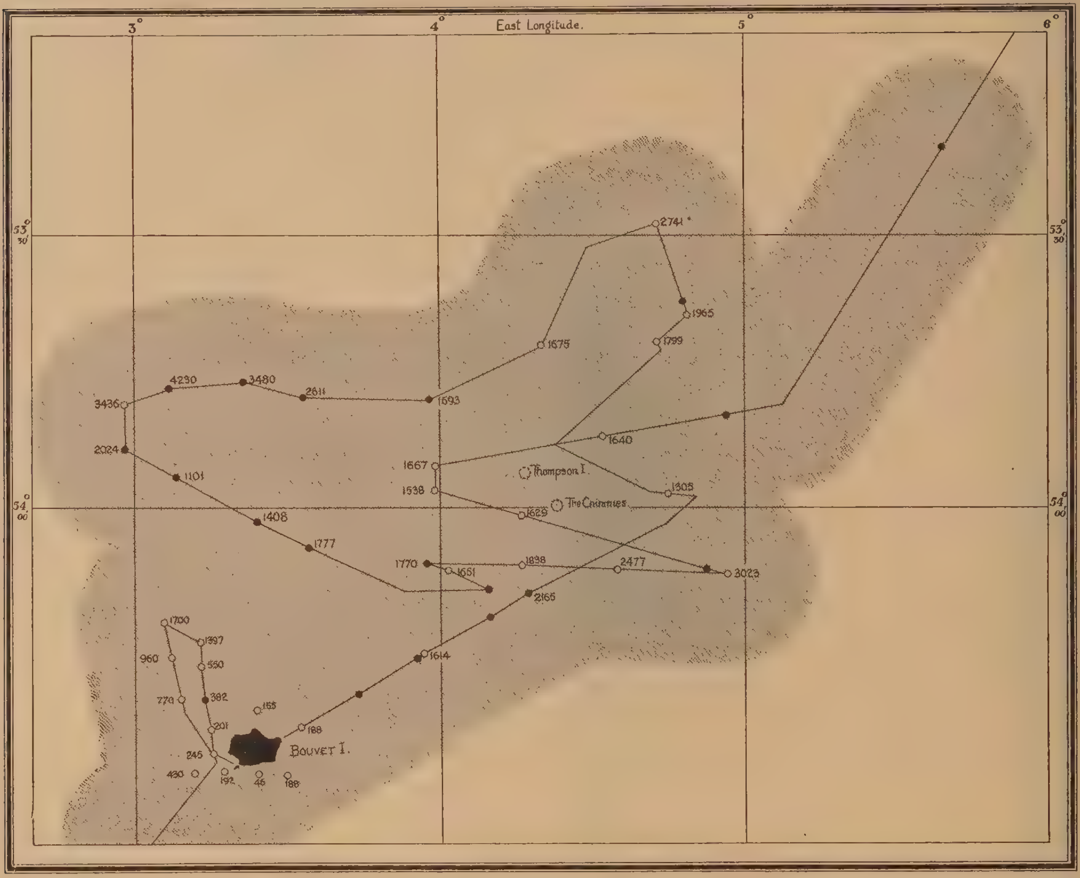
3°
4°
East Longitude.
5°
6°
53° 30'
54° 00'
2741
1965
1675
1799
4230
3480
2611
3436
1593
2024
1640
1101
1667
Thompson I.
1538
1305
The Chimneys
1629
1408
1777
1770
1838
2477
1651
3023
2165
1700
1397
960
550
1614
770
382
155
201
188
Bouvet I.
245
430
192
46
188

Fig. 5.

Area covered in the search for Thompson Island and the Chimneys. Black dots are points at which ship's position was accurately fixed. Shaded area represents the limit of visibility from the crow's nest. The figures show soundings in metres.

for by the 'Valdivia' in 1898, the 'Meteor' in 1926 and the 'Norvegia' in 1928, the 'Meteor' obtaining a sounding of 1580 m. on one of its supposed positions. The 'Norvegia', as we learn from Bjarne Aagard,[1] spent a number of days in searching for the island both to the east and west of Bouvet Island, and she appears to have covered a considerable part of the area which we ourselves examined: this, however, was not known to us at the time. It is to be hoped that a chart showing the track of the 'Norvegia', and the soundings obtained, will soon be published.

When the 'Discovery II' searched unsuccessfully for the island in October 1930, we were largely guided as to the area to be searched by the latest information supplied by the Hydrographic Department of the Admiralty, which gave particulars of all previous searches and the area which might still be regarded as unexamined. The 'Discovery II' was very fortunate in having fine clear weather which made it possible to fix the ship's position at frequent intervals, but a rough sea made echo sounding difficult and only twenty-five soundings were obtained. The area examined was over 3000 square miles, as can be seen from Fig. 5. This figure also shows the limit of visibility from the crow's nest, and the results indicate that although a definite plateau exists to the north-eastward of Bouvet Island, there is no indication in this area of either Thompson Island or the Chimneys. The soundings obtained near the charted position of the island by the 'Discovery II' were 1538 and 1629 m., which agree very closely with the 'Meteor's' sounding of 1580 m. As a result of the latest search these islands have been removed from the British Admiralty Charts and Sailing Directions (see Admiralty Notice to Mariners No. 406 of 1931).

The following instance is an example of the means by which dangers and shoals come to be reported without careful examination: When the 'Discovery II' was in the neighbourhood of the South Sandwich Deep in November 1930, a shoal of approximately 200 fathoms was reported by a whaling factory ship from a position where we had found considerably deeper water. On asking for further details we were informed that this depth had been obtained by one of their catchers after harpooning a whale, as the line had run out vertically downwards for 200 fathoms and then had suddenly become slack.

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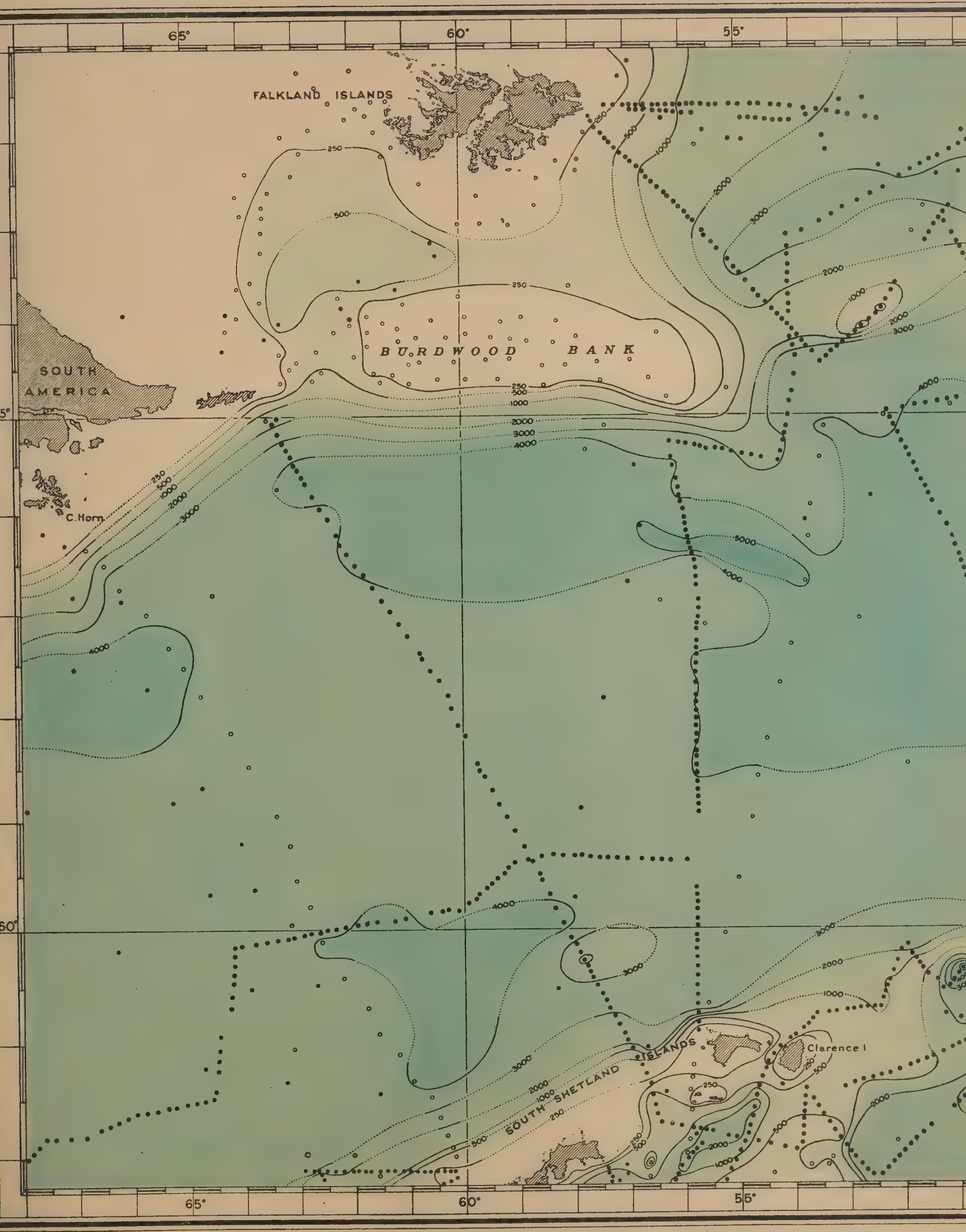
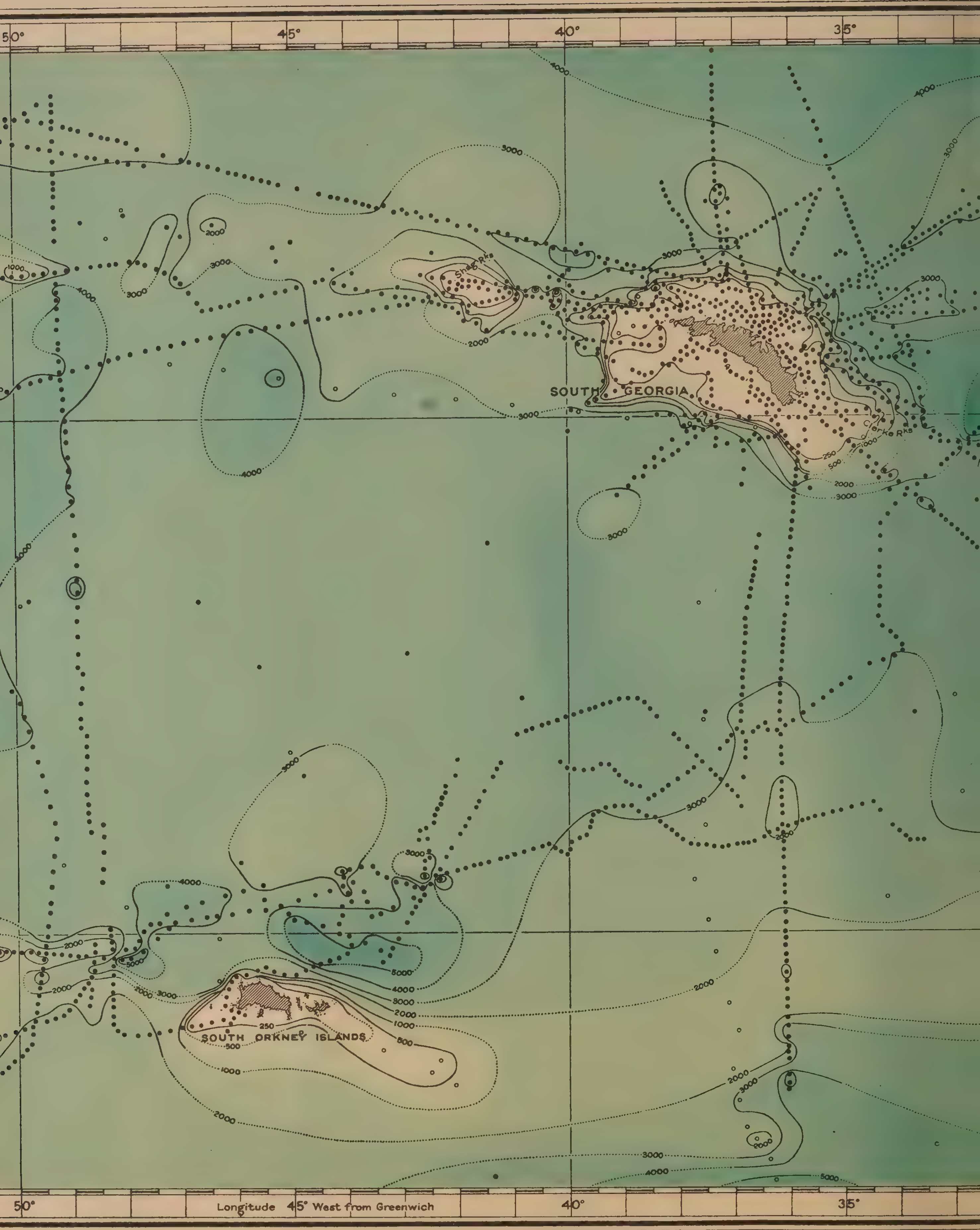
[1] Bjarne Aagard, *Fangst og Forskning i Sydishavet*, pp. 626–37, Oslo (1930).

Echo-sounding table compiled from observations made at St. 471 in the South Sandwich Deep

Range of deep-water machine in seconds	Half-average sounding velocity per second		Depth	
	Fathoms	Metres	Fathoms	Metres
0–0·277	393·95	720·45	0–109	0–200
0·277–0·415	394·37	721·25	109–164	200–300
0·415–0·553	395·25	722·35	164–219	300–400
0·553–0·689	395·95	724·12	219–273	400–500
0·689–0·827	396·47	725·10	273–328	500–600
0·827–0·965	396·87	725·80	328–383	600–700
0·965–1·099	397·25	726·47	383–437	700–800
1·099–1·237	397·65	727·35	437–492	800–900
1·237–1·374	397·95	727·90	492–547	900–1000
1·374–1·713	398·42	728·63	547–683	1000–1250
1·713–2·053	399·07	729·80	683–820	1250–1500
2·053–2·393	399·70	730·95	820–957	1500–1750
2·393–2·731	400·30	731·80	957–1094	1750–2000
2·731–3·066	400·87	733·12	1094–1230	2000–2250
3·066–3·403	401·45	734·17	1230–1367	2250–2500
3·403–3·738	402·02	735·22	1367–1504	2500–2750
3·738–4·070	402·60	736·27	1504–1640	2750–3000
4·070–4·404	403·20	737·32	1640–1777	3000–3250
4·404–4·737	403·75	738·40	1777–1914	3250–3500
4·737–5·068	404·30	739·47	1914–2051	3500–3750
5·068–5·397	404·95	740·52	2051–2187	3750–4000
5·397–5·726	405·50	741·57	2187–2324	4000–4250
5·726–6·056	406·05	742·62	2324–2461	4250–4500
6·056–6·381	406·65	743·67	2461–2597	4500–4750
6·381–6·708	407·25	744·75	2597–2734	4750–5000
6·708–7·035	407·85	745·82	2734–2871	5000–5250
7·035–7·357	408·40	746·90	2871–3007	5250–5500
7·357–7·681	409·00	748·00	3007–3144	5500–5750
7·681–8·004	409·60	749·10	3144–3281	5750–6000
8·004–8·324	410·20	750·20	3281–3417	6000–6250
8·324–8·645	410·80	751·30	3417–3554	6250–6500
8·645–8·964	411·42	752·42	3554–3691	6500–6750
8·964–9·282	412·07	753·60	3691–3828	6750–7000
9·282–9·586	412·65	754·65	3828–3964	7000–7250
9·586–9·917	413·20	755·67	3964–4101	7250–7500
9·917–10·234	413·80	756·75	4101–4238	7500–7750
10·234–10·472	414·40	757·85	4238–4374	7750–8000

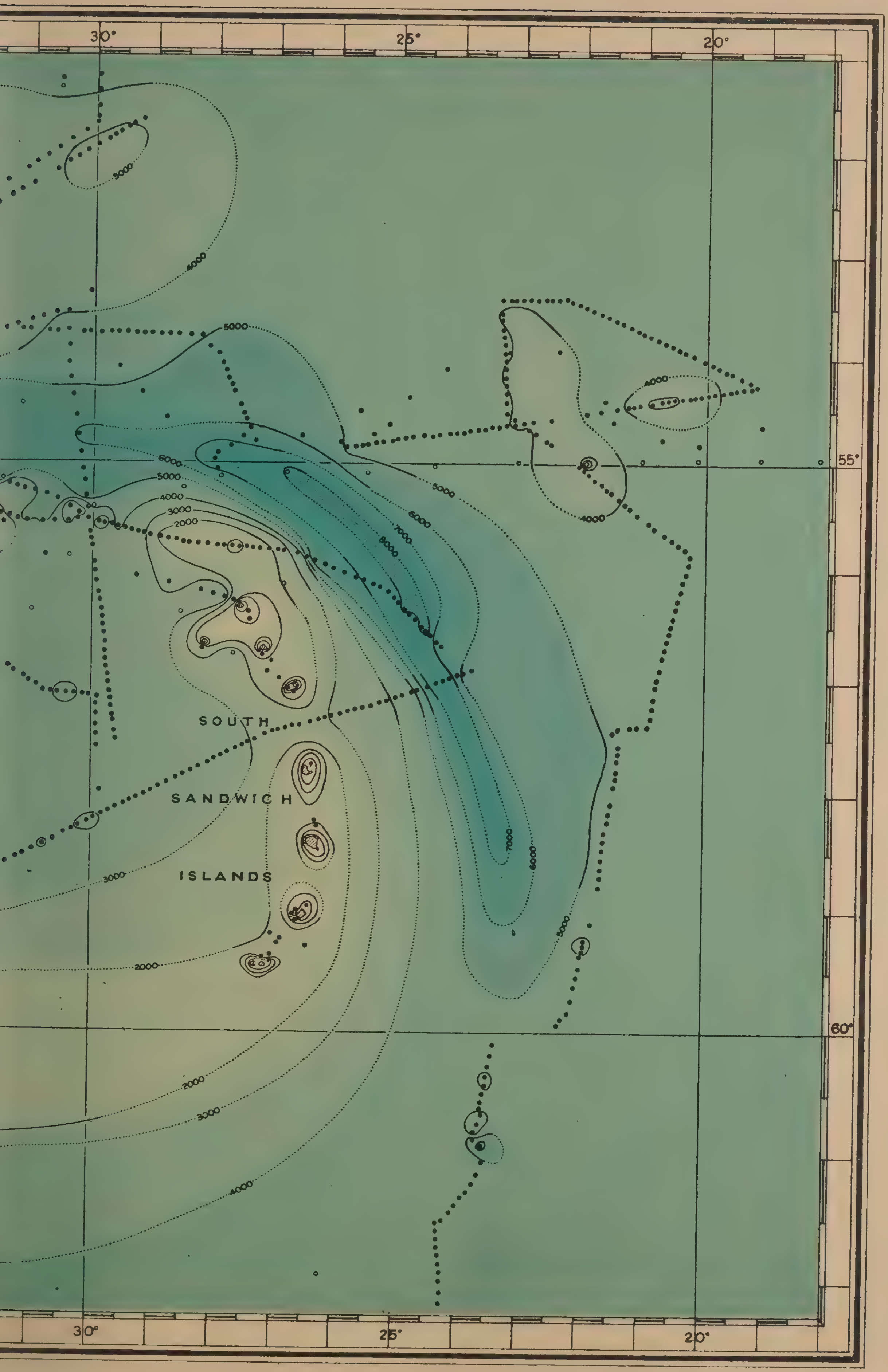

65°
60°
55°
FALKLAND ISLANDS
BURDWOOD BANK
SOUTH AMERICA
C. Horn
SOUTH SHETLAND ISLANDS
Clarence I
250
500
1000
2000
3000
4000
5000
55°
60°

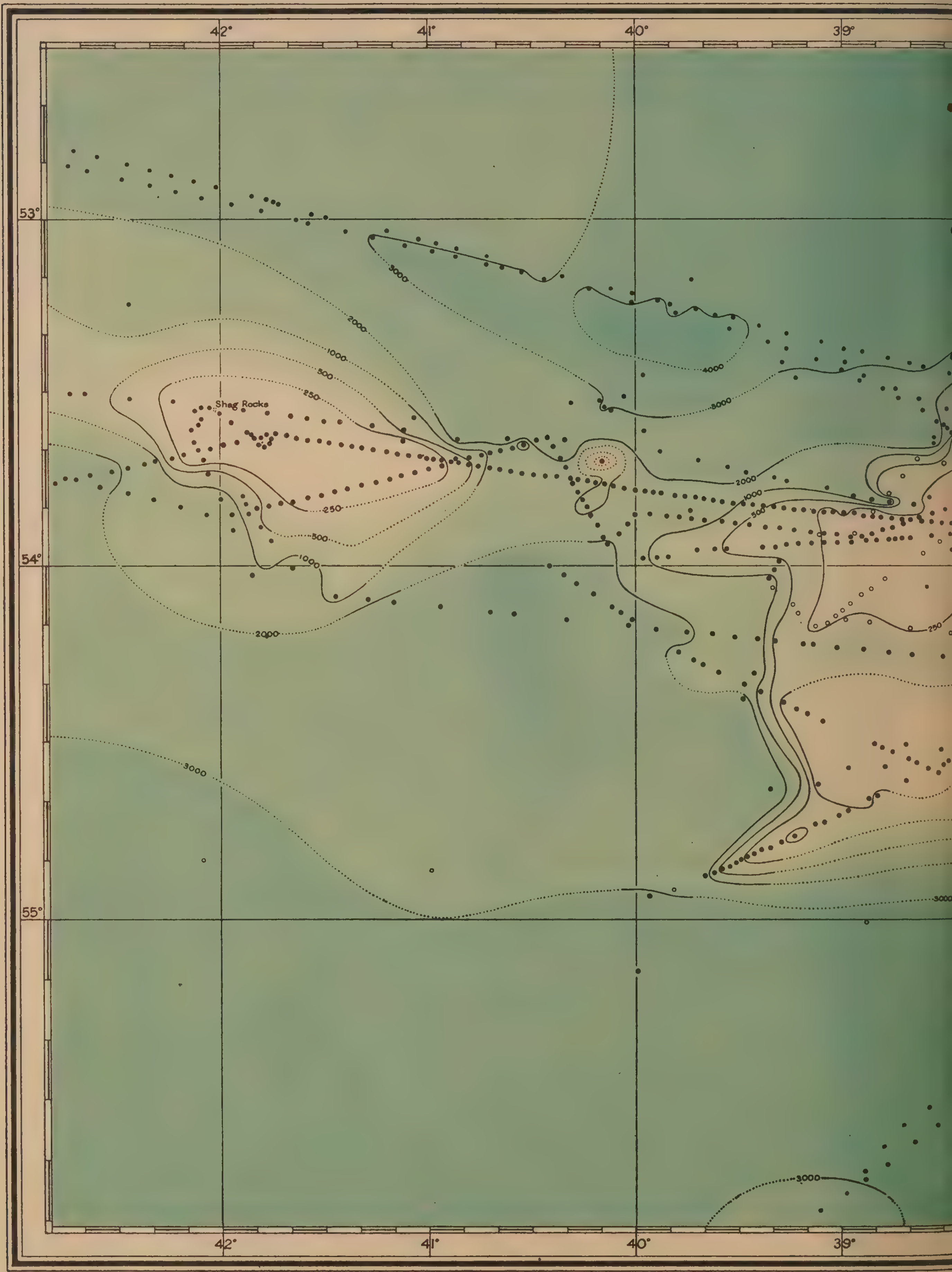

50°
45°
40°
35°
SOUTH GEORGIA
Shag Rks
Clerke Rks
SOUTH ORKNEY ISLANDS
Longitude 45° West from Greenwich
1000
2000
3000
4000
5000
250
500

THE SCOTIA SEA.

Positions of soundings taken during the Discovery Investigations are shown in black.

PLATE XLV

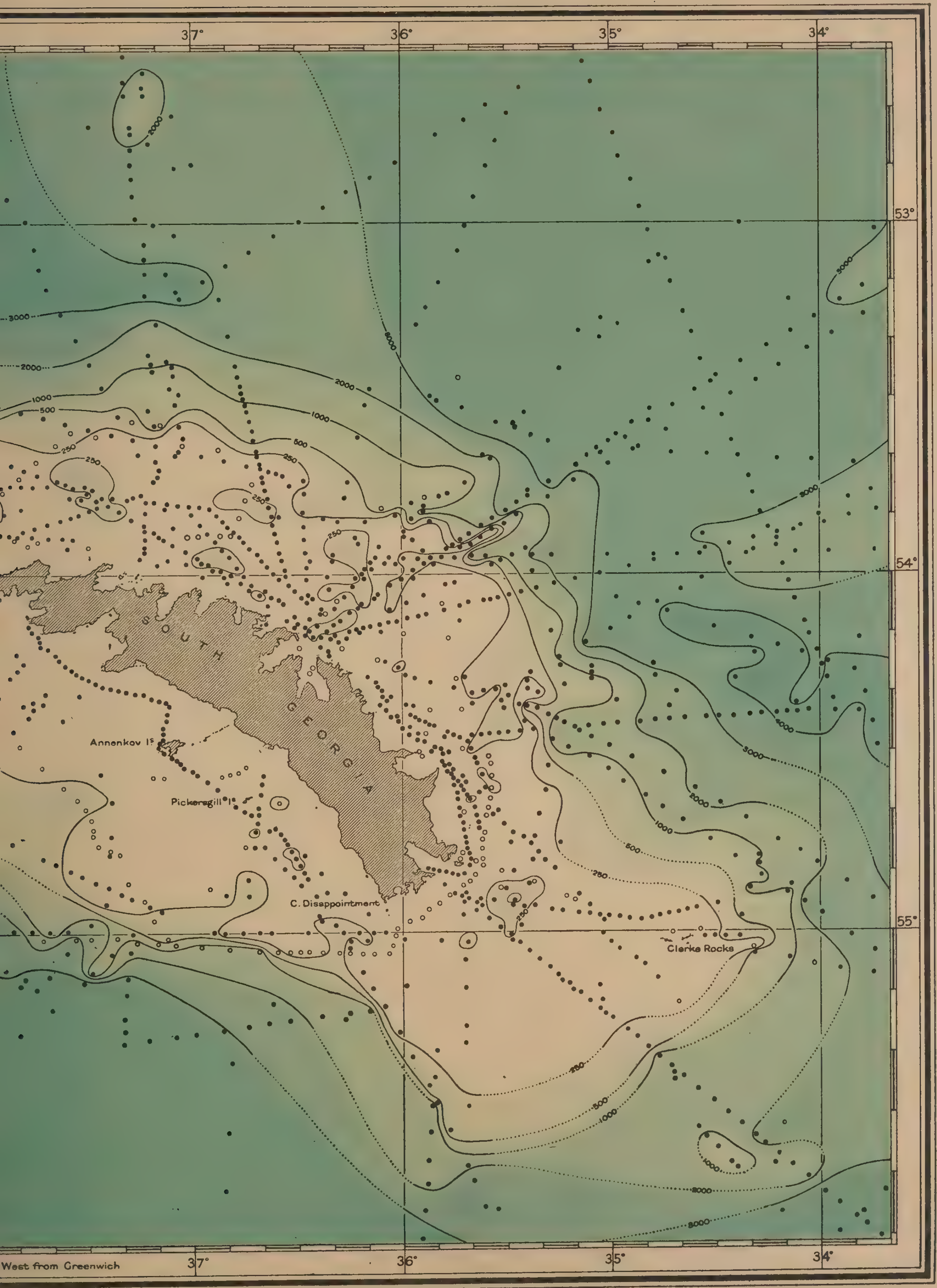

30°
25°
20°
55°
60°
3000
4000
5000
6000
7000
8000
2000
SOUTH
SANDWICH
ISLANDS
30°
25°
20°


42°
41°
40°
39°
53°
54°
55°
Shag Rocks
250
500
1000
2000
3000
4000

SOUTH GEORGIA

Positions of soundings taken during

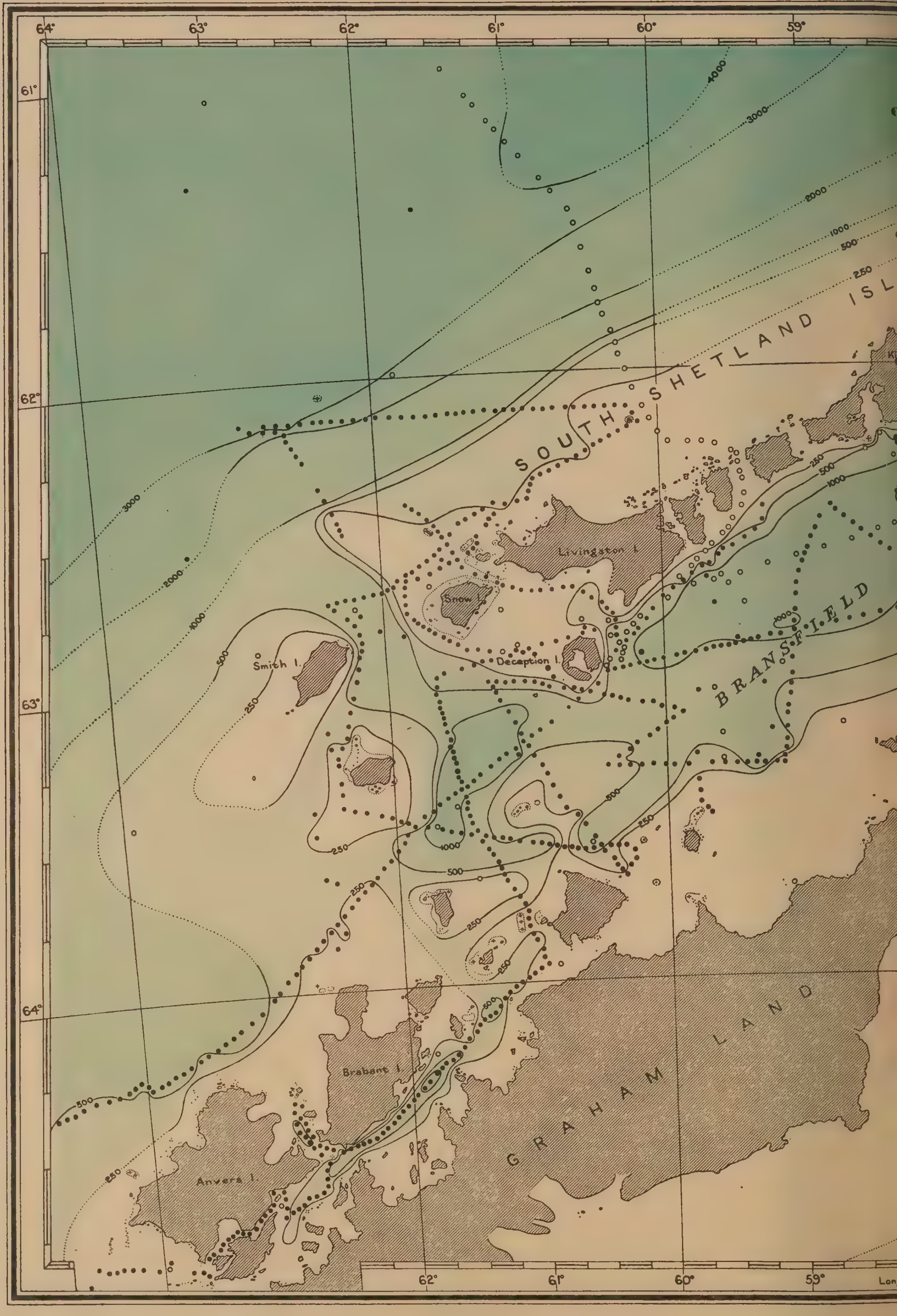
PLATE XLVI



37°
36°
35°
34°
53°
54°
55°
SOUTH GEORGIA
Annenkov Is
Pickersgill Is
C. Disappointment
Clerke Rocks
3000
2000
1000
500
250
West from Greenwich

SHAG ROCKS.

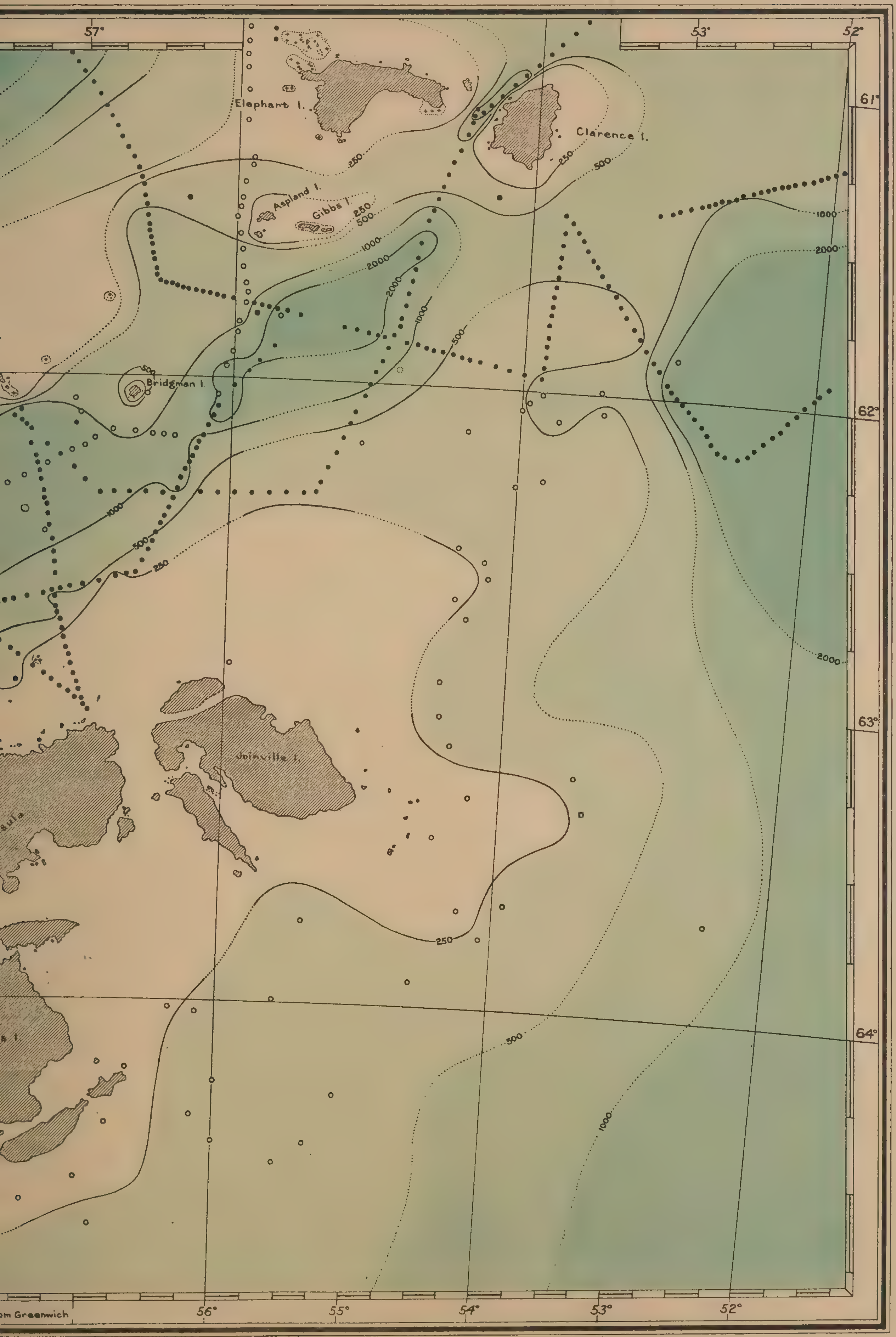
Investigations are shown in black.


64°
63°
62°
61°
60°
59°
61°
62°
63°
64°
4000
3000
2000
1000
500
250
SOUTH SHETLAND ISL
Livingston I.
Snow I.
Smith I.
Deception I.
BRANSFIELD
Brabant I.
Anvers I.
GRAHAM LAND
Lon

BRANSFIELD STRAI

Positions of soundings taken during th

PLATE XLVII


57°
53°
52°
61°
Elephant I.
Clarence I.
250
500
Aspland I.
Gibbs I.
1000
2000
1000
2000
500
Bridgman I.
62°
1000
500
250
2000
Joinville I.
sula
63°
250
500
64°
s I.
1000
om Greenwich
56°
55°
54°
53°
52°

JACENT WATERS.

Investigations are shown in black.

[*Discovery Reports. Vol. VI, pp.* 237–392, *Plates XLVIII–LVII, December,* 1932]

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INVESTIGATIONS

SPONGES

By

MAURICE BURTON, M.Sc.

Assistant-Keeper, Department of Zoology,
British Museum (Nat. Hist.)

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SPONGES

By Maurice Burton, M.Sc.
Assistant-Keeper, Department of Zoology,
British Museum (Nat. Hist.)

(Plates XLVIII–LVII, text-figs. 1–56)

INTRODUCTION

This report is based on the study of material collected by the R.R.S. 'Discovery', the R.S.S. 'William Scoresby' and the staff of the Marine Biological Station at South Georgia during the years 1925–9. In many respects the collections obtained are of unusual interest, including as they do specimens from the West African coast and from the area around Tristan da Cunha, for our knowledge of the sponge faunas of these two localities is as yet meagre. The rest of the material was obtained mainly from South Georgia, South Shetlands, the Falkland Islands and the extreme southern part of the South American continent.

The sponges in these collections are abundant and well preserved and include representatives of 168 species and varieties, of which only 35 are new: but the more important feature of the collection is the fact that many of the species are each represented by numerous individuals. Five species of *Tedania*, for example, are represented by nearly 200 specimens of all sizes. When abundant material is to hand for comparative study, it is always found that the prevailing ideas concerning the species in question require radical revision. It has been possible to show here that the variations in *T. massa*, Ridley and Dendy, go far beyond what might *a priori* have been expected. Moreover, the extremes of fluctuation in the dimensions of the spicules, within a given species, are considerably wider apart than has hitherto been thought to be the case. This is strikingly demonstrated in *Iophon chelifer*, Ridley and Dendy, in which species again considerable quantities of material are available.

In addition to the usual systematic studies, a certain amount of data is made available from the identification of the Discovery collections concerning the development and the breeding seasons of Antarctic species, and our knowledge of the distribution of species in the South Atlantic and Antarctic is considerably increased.

SYSTEMATIC LIST OF SPECIES

Sub-kingdom PARAZOA

Phylum NUDA

Order HEXACTINELLIDA

Family ROSSELLIDAE

Genus *Rossella*, Carter.
  R. antarctica, var. ***intermedia***, n.
  R. nuda, Topsent.
  R. racovitzae, Topsent.
  R. villosa, Burton.
Genus *Gymnorossella*, Topsent.
  G. inermis, Topsent.

Phylum GELATINOSA

Order CALCAREA

Family HOMOCOELIDAE

- Genus *Leucosolenia*, Bowerbank.
  - *L. macleayi* (Lendenfeld).
  - *L. discovereyi*, Jenkin.

Family LEUCASCIDAE

- Genus *Pericharax*, Poléjaeff.
  - ***P. pyriformis***, sp.n.
- Genus *Leucetta*, Haeckel.
  - *L. leptoraphis* (Jenkin).
  - *L. macquariensis*, Dendy.

Family LEUCALTIDAE

- Genus *Leucaltis*, Haeckel.
  - ***L. gastrorhabdifera***, sp.n.
- Genus *Leucettusa*, Haeckel.
  - *L. haeckeliana* (Poléjaeff).
  - ***L. simplicissima***, sp.n.

Family GRANTIIDAE

- Genus *Grantia*, Fleming.
  - *G. cirrata*, var. *aurorae*, Dendy.
  - ***G. cirrata***, var. ***tenuipilosa***, n.

Order TETRAXONIDA

Sub-order *HOMOSCLEROPHORA*

Family PLAKINIDAE

- Genus *Plakina*, Schulze.
  - *P. monolopha*, Schulze.
  - *P. trilopha*, Schulze.

Sub-order *STREPTASTROSCLEROPHORA*

Family PACHASTRELLIDAE

- Genus *Pachastrella*, Schmidt.
  - *P. monilifera*, Schmidt.
- Genus *Poecillastra*, Sollas.
  - *P. compressa* (Bowerbank).

Sub-order *ASTROSCLEROPHORA*

Family GEODIIDAE

- Genus *Geodia*, Lamarck.
  - *G. magellani* (Sollas).

Family ERYLIDAE

- Genus *Erylus*, Gray.
  - *E. discophorus* (Schmidt).

Sub-order *SIGMATOSCLEROPHORA*

Family TETILLIDAE

- Genus *Tetilla*, Schmidt.
  - *T. leptoderma* (Sollas).
- Genus *Cinachyra*, Sollas.
  - *C. antarctica* (Carter).
  - *C. barbata*, Sollas.
  - *C. coactifera* (Lendenfeld).

Family HAPLOSCLERIDAE

- Genus *Haliclona*, Grant.
  - *H. nodosa* (Thiele).
  - *H. chilensis* (Thiele).
  - *H. variabilis* (Thiele).
  - *H. penicillata* (Topsent).
  - *H. gaussiana* (Hentschel).
  - *H. tubuloramosa* (Dendy).
  - *H. conica* (Brøndsted).
  - ***H. bilamellata***, sp.n.
  - ***H. stephensi***, sp.n.
  - ***H. petrosioides***, sp.n.
- Genus ***Haliclonissa***, gen.n.
  - ***H. verrucosa***, sp.n.
  - ***H. sacciformis***, sp.n.
- Genus *Microxina*, Topsent.
  - *M. benedeni* (Topsent).
- Genus ***Hemigellius***, gen.n.
  - *H. rudis* (Topsent).
  - ***H. pachyderma***, sp.n.
- Genus *Adocia*, Gray.
  - *A. carduus* (Ridley and Dendy).
  - *A. glacialis* (Ridley and Dendy).
  - *A. siphonella* (Thiele).
  - *A. cucurbitiformis* (Kirkpatrick).
  - *A. tremulus* (Topsent).
  - *A. tenellus* (Topsent).
- Genus *Calyx*, Vosmaer.
  - *C. arcuarius* (Topsent).
  - *C. kerguelensis* (Hentschel).
- Genus *Dasychalina*, Ridley and Dendy.
  - *D. validissima* (Thiele).
- Genus *Callyspongia*, Duchaissang and Michelotti.
  - *C. fortis* (Ridley).
  - *C. fusifera* (Thiele).
  - ***C. flabellata***, sp.n.
- Genus *Phloeodictyon*, Carter.
  - *P. eumitum*, Kirkpatrick.

Family DESMACIDONIDAE

- Section Isodictyeae.
  - Genus *Isodictya*, Bowerbank.
    - *I. kerguelensis* (Ridley and Dendy).
    - *I. kerguelensis*, var. *simillima* (Hentschel).
    - *I. setifer* (Topsent).
    - *I. delicata* (Thiele).
    - *I. antarctica* (Kirkpatrick).
    - *I. cactoides* (Kirkpatrick).
    - *I. microchela* (Topsent).
    - *I. erinacea* (Topsent).
    - ***I. toxophila***, sp.n.
  - Genus *Guitarra*, Carter.
    - *G. fimbriata*, Carter.
  - Genus *Cercidochela*, Kirkpatrick.
    - *C. lankesteri*, Kirkpatrick.
  - Genus *Plumocolumella*, Burton.
    - *P. maeandrina* (Kirkpatrick).
    - ***P. myxillioides***, sp.n.
- Section Mycaleae.
  - Genus *Mycale*, Gray.
    - *M. magellanica* (Ridley).
    - *M. lapidiformis* (Ridley and Dendy).
    - *M. acerata*, Kirkpatrick.
    - *M. tridens*, Hentschel.
    - ***M. macrochela***, sp.n.
  - Genus *Amphilectus*, Vosmaer.
    - *A. fucorum* (Esper).
    - *A. rugosa* (Thiele).
    - ***A. flabellata***, sp.n.
  - Genus *Biemna*, Gray.
    - *B. chilensis*, Thiele.
  - Genus *Asbestopluma*, Norman.
    - *A. calyx*, Hentschel.
  - Genus *Arenochalina*, Lendenfeld.
    - ***A. incrustans***, sp.n.
  - Genus *Acanthorhabdus*, Burton.
    - *A. fragilis*, Burton.
  - Genus ***Sigmotylotella***, gen.n.
    - ***S. suberitoides***, sp.n.
- Section Iophoneae.
  - Genus *Iophon*, Gray.
    - *I. radiatus*, Topsent.
    - *I. proximum* (Ridley).
- Section Tedanieae.
  - Genus *Tedania*, Gray.
    - *T. tenuicapitata*, Ridley.
    - *T. massa*, Ridley and Dendy.
    - *T. spinata* (Ridley).
    - *T. charcoti*, Topsent.
    - *T. murdochi*, Topsent.
    - *T. oxeata*, Topsent.
- Section Myxilleae.
  - Genus *Myxilla*, Schmidt.
    - *M. mollis*, Ridley and Dendy.
    - *M. australis* (Topsent).
    - *M. asigmata*, Topsent.
    - *M. chilensis*, Thiele.
    - *M. elongata*, Topsent.
    - ***M. basimucronata***, sp.n.
    - ***M. verrucosa***, sp.n.

- Section Myxilleae (*continued*)
  - Genus *Ectyodoryx*, Lundbeck.
    - *E. paupertas*, subsp. *nobile* (Ridley and Dendy).
    - *E. antarctica* (Hentschel).
    - *E. frondosa*, var. *anacantha*, Hentschel.
    - *E. ramilobosa* (Topsent).
  - Genus *Anchinoë*, Gray.
    - *A. latrunculioides* (Ridley and Dendy).
    - *A. areolata* (Thiele).
    - *A. leptochela* (Hentschel).
  - Genus *Stelodoryx*, Topsent.
    - *S. pluridentata* (Lundbeck).
    - ***S. discovereyi***, sp.n.
  - Genus *Kirkpatrickia*, Topsent.
    - *K. variolosa* (Kirkpatrick).
    - *K. coulmani* (Kirkpatrick).
  - Genus *Acheliderma*, Topsent.
    - ***A. topsenti***, sp.n.
  - Genus *Inflatella*, Schmidt.
    - *I. belli* (Kirkpatrick).
- Section Plocamieae.
  - Genus *Plocamia*, Schmidt.
    - *P. gaussiana*, Hentschel.
- Section Clathrieae.
  - Genus *Clathria*, Schmidt.
    - *C. papillosa*, Thiele.
    - *C. toxipraedita*, Topsent.
    - ***C. lipochela***, sp.n.
  - Genus *Rhaphidophlus*, Ehlers.
    - ***R. paucispiculus***, sp.n.
  - Genus ***Protoclathria***, gen.n.
    - ***P. simplicissima***, sp.n.
  - Genus *Ophlitaspongia*, Bowerbank.
    - *O. membranacea*, Thiele.
    - ***O. thielei***, sp.n.
  - Genus *Artemisina*, Vosmaer.
    - *A. apollinis* (Ridley and Dendy).
    - *A. plumosa*, Hentschel.
  - Genus *Dictyociona*, Topsent.
    - *D. discreta* (Thiele).
    - *D. terrae-novae* (Dendy).
  - Genus *Axociella*, Hallmann.
    - *A. nidificata* (Kirkpatrick).
    - *A. flabellata* (Topsent).
  - Genus *Pseudanchinoë*, Burton.
    - *P. toxifera* (Topsent).
  - Genus *Eurypon*, Gray.
    - *E. miniaceum*, Thiele.
  - Genus *Stylotellopsis*, Thiele.
    - *S. amabilis*, Thiele.
  - Genus *Raspaxilla*, Topsent.
    - *R. phakellina*, Topsent.
- Section Hymedesmieae.
  - Genus *Hymedesmia*, Bowerbank.
    - *H. irritans*, Thiele.
    - *H. laevis*, Thiele.
    - *H. simillima*, var. *antarctica*, Hentschel.
    - ***H. longurioides***, sp.n.
- Section Crelleae.
  - Genus *Crella*, Gray.
    - *C. crassa* (Hentschel).
  - Genus *Crellina*, Hentschel.
    - *C. tubifex*, Hentschel.

Family AXINELLIDAE

- Genus *Hymeniacidon*, Bowerbank.
  - *H. caruncula*, Bowerbank.
  - *H. sanguinea* (Grant).
  - *H. fernandezi*, Thiele.
  - *H. torquata*, Topsent.
  - ***H. dubia***, sp.n.
- Genus ***Thieleia***, gen.n.
  - *T. rubiginosa* (Thiele).
- Genus *Axinella*, Schmidt.
  - *A. crinita*, Thiele.
- Genus *Pseudaxinella*, Thiele.
  - *P. egregia* (Ridley).
- Genus *Homaxinella*, Topsent.
  - *H. supratumescens* (Topsent).
- Genus *Rhizaxinella*, Keller.
  - *R. australiensis*, Hentschel.
- Genus *Stylohalina*, Kirk.
  - *S. hirta* (Topsent).
- Genus ***Plicatellopsis***, gen.n.
  - ***P. arborescens***, sp.n.
  - ***P. flabellata***, sp.n.
- Genus *Bubaris*, Gray.
  - *B. vermiculata* (Bowerbank).
  - *B. murrayi*, Topsent.
- Genus *Ceratopsis*, Thiele.
  - ***C. incrustans***, sp.n.
- Genus *Eumastia*, Schmidt.
  - *E. attenuata*, Topsent.

Family CLAVULIDAE

- Genus *Suberites*, Nardo.
  - *S. montiniger*, Carter.
  - *S. microstomus*, var. *stellatus*, Kirkpatrick.
  - *S. papillatus*, Kirkpatrick.

- Genus *Pseudosuberites*, Topsent.
  - *P. hyalinus* (Ridley and Dendy).
  - *P. sulcatus*, Thiele.
- Genus *Tentorium*, Vosmaer.
  - *T. semisuberites* (Schmidt).
- Genus *Polymastia*, Bowerbank.
  - *P. isidis*, Thiele.
  - *P. invaginata*, Kirkpatrick.
- Genus *Sphaerotylus*, Topsent.
  - *S. antarcticus*, Kirkpatrick.
- Genus *Stylocordyla*, Thomson.
  - *S. borealis*, subsp. *acuata*, Kirkpatrick.
- Genus *Spirastrella*, Schmidt.
  - *S. purpurea* (Lamarck).
- Genus *Latrunculia*, Bocage.
  - *L. lendenfeldi*, Hentschel.
- Genus *Cliona*, Grant.
  - ***C. aethiopicus***, sp.n.

Order EUCERATOSA

- Genus *Halisarca*, Dujardin.
  - *H. dujardini*, var. *magellanica*, Topsent.
- Genus *Spongia*, Linnaeus.
  - *S. officinalis*, Linnaeus.
  - *S. magellanica*, Thiele.
- Genus *Duseideia*, Johnston.
  - *D. fragilis* (Montagu).
  - *D. chilensis* (Thiele).
  - ***D. tenuifibra***, sp.n.
- Genus *Dendrilla*, Lendenfeld.
  - *D. membranosa* (Pallas).

LIST OF STATIONS: WITH THE NAMES OF SPECIES COLLECTED AT EACH

R.R.S. 'DISCOVERY'

St. 1. 16. xi. 25. Clarence Bay, Ascension Island, 7° 55′ 15″ S, 14° 25′ W. Rectangular net, coralline sand and shell, 16–27 m.

Spongia officinalis, Linnaeus.
Duseideia fragilis (Montagu).

St. 2. 17. ix. 25. Clarence Bay, Ascension Island, Catherine's Point and Collyer Point. Shore collecting.

Arenochalina incrustans, sp.n.

St. 6. 1. ii. 25. Tristan da Cunha, 3 miles N 30° E of Settlement. Large dredge, rock, 80–140 m.

Leucosolenia macleayi (Lendenfeld).
Leucaltis gastrorhabdifera, sp.n.
Plakina monolopha, Schulze.
Pachastrella monilifera, Schmidt.
Poecillastra compressa (Bowerbank).
Erylus discophorus (Schmidt).
Haliclona petrosioides, sp.n.
Adocia siphonella (Thiele).
Phloeodictyon eumitum, Kirkpatrick.
Amphilectus fucorum (Esper).
A. rugosus (Thiele).
Sigmotylotella suberitoides, sp.n.
Iophon proximum (Ridley).
Protoclathria simplicissima, sp.n.
Hymedesmia irritans, Thiele.
Hymeniacidon torquata, Topsent.
Pseudaxinella egregia (Ridley).
Bubaris vermiculata (Bowerbank).
B. murrayi, Topsent.
Ceratopsis incrustans, sp.n.
Pseudosuberites hyalinus (Ridley and Dendy).
Tentorium semisuberites (Schmidt).

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 3·3 miles S 44° E of Jason Light. Large dredge, rock, 110 m.

Cinachyra barbata, Sollas.
Plumocolumella maeandrina (Kirkpatrick).

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock. Otter trawl, grey mud, 179–235 m.

Rossella nuda, Topsent.
Leucetta leptoraphis (Jenkin).
Tetilla leptoderma (Sollas).
Cinachyra coactifera (Lendenfeld).
Microxina benedeni (Topsent).
Hemigellius rudis (Topsent).
Calyx arcuarius (Topsent).
Isodictya setifer (Topsent).
I. cactoides (Kirkpatrick).
I. toxophila, sp.n.
Guitarra fimbriata, Carter.
Iophon proximum (Ridley).
Tedania charcoti, Topsent.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light. Otter trawl, 120–204 m.

Rossella antarctica, var. *intermedia*, n.
Leucetta leptoraphis (Jenkin).
Cinachyra antarctica (Carter).
C. barbata, Sollas.
Haliclona gaussiana (Hentschel).
Hemigellius rudis (Topsent).
Isodictya setifer (Topsent).
I. antarctica (Kirkpatrick).
Plumocolumella maeandrina (Kirkpatrick).
Mycale acerata, Kirkpatrick.
Amphilectus fucorum (Johnston).
Iophon proximum (Ridley).
Tedania massa, Ridley and Dendy.
Myxilla mollis, Ridley and Dendy.
M. basimucronata, sp.n.
Anchinoë leptochela (Thiele).
Kirkpatrickia coulmani (Kirkpatrick).
Plocamia gaussiana, Hentschel.
Ophlitaspongia thielei, sp.n.
Artemisina apollinis (Ridley and Dendy).
Polymastia invaginata, Kirkpatrick.
Stylocordyla borealis (Lovén), subsp. *acuata*, Kirkpatrick.

St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia. Otter trawl, grey mud, 238–270 m.

Rossella nuda, Topsent.
Mycale acerata, Kirkpatrick.
Dendrilla membranosa (Pallas).

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Island, from 7 miles N 50° E to 7·6 miles N 63° E of Eddystone Rock. Otter trawl, fine sand, 105–115 m.

Dasychalina validissima (Thiele).
Amphilectus fucorum (Johnston).
Iophon proximum (Ridley).
Tedania spinata (Ridley).
Clathria lipochela, sp.n.

St. 53. 12. v. 26. Port Stanley, East Falkland Island, Hulk of 'Great Britain'. Mussel rake, 0–2 m.

Leucosolenia discovereyi, Jenkin.
Leucetta macquariensis, Dendy.
Grantia cirrata, var. *aurorae*, Dendy.
G. cirrata, var. *tenuipilosa*, n.
Haliclona variabilis (Thiele).
Dasychalina validissima (Thiele).
Mycale magellanica (Ridley).
Tedania murdochi, Topsent.
Hymeniacidon fernandezi, Thiele.
Eumastia attenuata, Topsent.

St. 55. 16. v. 26. Entrance to Port Stanley, East Falkland Island, 2 cables S 24° E of Navy Point. Small beam trawl, 10–16 m.

Leucetta macquariensis, Dendy.
Mycale magellanica (Ridley).
Halisarca dujardini, var. *magellanica*, Topsent.

St. 56. 16. v. 26. Sparrow Cove, Port William, East Falkland Island, 1½ cables N 50° E of Sparrow Point. Small beam trawl, 10½–16 m.

Leucetta macquariensis, Dendy.

St. 58. 19. v. 26. Port Stanley, East Falkland Island, on piles of Government Jetty.

Calyx kerguelensis (Hentschel).
Myxilla chilensis, Thiele.
Hymedesmia laevis, Thiele.
Pseudosuberites sulcatus, Thiele.
Halisarca dujardini, var. *magellanica*, Topsent.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia. From 4·1 miles N 54° E of Larsen Point to 1·2 miles S 62° W of Merton Rock. Large otter trawl, grey mud, 230–250 m.

Rossella nuda, Topsent.
Cinachyra barbata, Sollas.
Isodictya cactoides (Kirkpatrick).
Plumocolumella maeandrina (Kirkpatrick).
Iophon radiatus, Topsent.
Myxilla mollis, Ridley and Dendy.
Stylocordyla borealis, subsp. *acuata* (Kirkpatrick).

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia. From 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W. Large otter trawl, green mud and stones, 122–136 m.

Leucetta leptoraphis (Jenkin).
Placina trilopha, Schulze.
Tetilla leptoderma (Sollas).
Cinachyra barbata, Sollas.
Adocia glacialis (Ridley and Dendy).
Calyx kerguelensis (Hentschel).
Dasychalina validissima (Thiele).
Tedania charcoti, Topsent.
Axociella flabellata (Topsent).

St. 143. 30. xii. 26. Off mouth of East Cumberland Bay, South Georgia, 54° 12′ S, 36° 29′ 30″ W. Large otter trawl, mud, 273 m.

Isodictya setifer (Topsent).

St. 144. 5. i. 7. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W. Large otter trawl, 4 mm. mesh, green mud and stones, 155–178 m.

Isodictya setifer (Topsent).
Clathria toxipraedita, Topsent.
Stylocordyla borealis, subsp. *acuata*, Kirkpatrick.

St. 145. 7. i. 27. Stromness Harbour, South Georgia, between Grass Island and Tonsberg Point. Small beam trawl, 26–35 m.

Leucetta macquariensis, Dendy.
Haliclona nodosa (Thiele).
Iophon radiatus, Topsent.
Tedania charcoti, Topsent.
Myxilla asigmata, Topsent.
Hymeniacidon fernandezi, Thiele.

St. 146. 8. i. 27. South Georgia, 53° 48′ S, 35° 37′ 30″ W. Large dredge, 728 m.

Mycale magellanica (Ridley).
Tedania charcoti, Topsent.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, from 54° 03′ S, 36° 39′ W to 54° 05′ S, 36° 36′ 30″ W. Large otter trawl, grey mud and stones, 132–148 m.

Rossella nuda, Topsent.
Leucetta leptoraphis (Jenkin).
Tetilla leptoderma (Sollas).
Calyx arcuarius (Topsent).
Isodictya setifer (Topsent).
I. toxophila, sp.n.
Plumocolumella maeandrina (Kirkpatrick).
Plocamia gaussiana, Hentschel.
Tedania massa, Ridley and Dendy.
T. charcoti, Topsent.
Ophlitaspongia thielei, sp.n.
Axociella nidificata (Kirkpatrick).
Homaxinella supratumescens (Topsent).

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N $76\frac{1}{2}$° W to 2·62 miles S 11° W of Merton Rock. Large otter trawl, mud, 200–234 m.

Microxina benedeni (Topsent).
Calyx arcuarius (Topsent).
Isodictya setifer (Topsent).
Plumocolumella maeandrina (Kirkpatrick).
Kirkpatrickia variolosa (Kirkpatrick).
Axociella flabellata (Topsent).

St. 152. 17. i. 27. South Georgia, 53° 51′ 30″ S, 36° 18′ 30″ W. Large dredge, rock, 245 m.

Rossella antarctica, var. *intermedia*, n.
Plakina trilopha, Schulze.
Anchinoë areolata (Thiele).
Tedania massa, Ridley and Dendy.
T. charcoti, Topsent.
Ophlitaspongia membranacea, Thiele.
Pseudosuberites hyalinus (Ridley and Dendy).
Suberites microstomus, var. *stellatus*, Kirkpatrick.

St. 153. 17. i. 27. South Georgia, 54° 08′ 30″ S, 36° 27′ 30″ W. Large dredge, rock, 106 m.

Cinachyra barbata, Sollas.

St. 155. 18. i. 27. South Georgia, 4·1 miles S 26½° E of Larsen Point. Large otter trawl, mud, 260 m.

Isodictya antarctica (Kirkpatrick).

St. 156. 20. i. 27. South Georgia, 53° 51′ S, 36° 21′ 30″ W. Large dredge, rock, 200–236 m.

Rossella antarctica, var. *intermedia*, n.
Leucetta macquariensis (Dendy).
Asbestopluma calyx, Hentschel.
Tedania massa, Ridley and Dendy.
Anchinoë latrunculioides (Ridley and Dendy).
Ophlitaspongia thielei, sp.n.
Eurypon miniaceum, Thiele.
Suberites papillatus (Kirkpatrick).
Pseudosuberites sulcatus, Thiele.
Polymastia invaginata, Kirkpatrick.
Spongia magellanica, Thiele.

St. 157. 20. i. 27. South Georgia, 53° 51′ S, 36° 11′ 15″ W. Large dredge, diatom ooze, stones and fine sand, 970 m.

Iophon proximum (Ridley).
Ectyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
Anchinoë areolata (Thiele).
Dictyociona terrae-novae (Dendy).
Thieleia rubiginosa (Thiele).
Pseudosuberites hyalinus (Ridley and Dendy).

St. 158. 21. i. 27. South Georgia, 53° 48′ 30″ S, 35° 57′ W. Large dredge, rock, 401–411 m.

Plumocolumella maeandrina (Kirkpatrick).
Tedania massa, Ridley and Dendy.
T. charcoti, Topsent.
Myxilla elongata, Topsent.
Ectyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
Rhizaxinella australiensis, Hentschel.

St. 159. 21. i. 27. South Georgia, 53° 52′ 30″ S, 36° 08′ W. Large dredge, rock, 160 m.

Calyx arcuarius (Topsent).
Isodictya setifer (Topsent).
Mycale acerata, Kirkpatrick.
Tedania massa, Ridley and Dendy.
Myxilla mollis, Ridley and Dendy.
Ectyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
E. ramilobosa (Topsent).
Anchinoë latrunculioides (Ridley and Dendy).
A. leptochela (Thiele).
Plocamia gaussiana, Hentschel.

St. 160. 7. ii. 27. Near Shag Rocks, 53° 43′ 40″ S, 40° 57′ W. Large dredge, grey mud, stones and rock, 177 m.

Rossella racovitzae, Topsent.
Pericharax pyriformis, sp.n.
Adocia carduus (Ridley and Dendy).
Calyx arcuarius (Topsent).
Isodictya setifer (Topsent).
Amphilectus fucorum (Esper).
Tedania massa, Ridley and Dendy.
T. charcoti, Topsent.
Myxilla elongata, Topsent.
Ectyodoryx antarctica (Hentschel).
Anchinoë latrunculioides (Ridley and Dendy).
A. areolata (Thiele).
Acheliderma topsenti, sp.n.
Plocamia gaussiana, Hentschel.
Rhaphidophlus paucispiculus, sp.n.
Pseudanchinoë toxifera (Topsent).
Hymedesmia longurioides, sp.n.
Hymeniacidon fernandezi, Thiele.
Suberites papillatus, Kirkpatrick.
Sphaerotylus antarcticus, Kirkpatrick.
Stylocordyla borealis, subsp. *acuata*, Kirkpatrick.

St. 163. 17. ii. 27. Paul Harbour, Signy Island, South Orkneys. Small beam trawl, 18–27 m.

Calyx arcuarius (Topsent).

St. 164. 18. ii. 27. East end of Normanna Strait, South Orkneys, near Cape Hansen, Coronation Island. Small beam trawl, 24–36 m.

Mycale acerata, Kirkpatrick.

St. 167. 20. ii. 27. Off Signy Island, South Orkneys, 60° 50′ 30″ S, 46° 15′ W. Large otter trawl, 7 mm. mesh, green mud, 244–344 m.

Polymastia invaginata, Kirkpatrick.
Stylocordyla borealis, subsp. *acuata*, Kirkpatrick.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W. Large dredge, rock, 342 m.

Tetilla leptoderma (Sollas).
Cinachyra barbata (Sollas).
Hemigellius rudis (Topsent).
Mycale tridens, Hentschel.
M. macrochela, sp.n.
Acanthorhabdus fragilis, Burton.
Iophon radiatus, Topsent.
T. oxeata, Topsent.
Suberites papillatus, Kirkpatrick.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 63° 17′ 20″ S, 59° 48′ 15″ W. Large dredge, mud, stones and gravel, 200 m.

Rossella antarctica, var. *intermedia*, n.
Cinachyra antarctica (Carter).
C. barbata, Sollas.
Adocia tremulus (Topsent).
Calyx arcuarius (Topsent).
Isodictya setifer (Topsent).
I. toxophila, sp.n.
Mycale magellanica (Ridley).
M. acerata, Kirkpatrick.
Iophon radiatus, Topsent.
Tedania massa, Ridley and Dendy.
Myxilla mollis, Ridley and Dendy.
Kirkpatrickia variolosa (Kirkpatrick).
Plocamia gaussiana, Hentschel.
Ophlitaspongia membranacea, Thiele.
Crella crassa, Hentschel.
Crellina tubifex, Hentschel.
Rhizaxinella australiensis, Hentschel.
Stylocordyla borealis, subsp. *acuata*, Kirkpatrick.

St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 63° 17′ 30″ S, 61° 17′ W. Large dredge, mud, coarse sand and stones, 1080 m.

Adocia carduus (Ridley and Dendy).
Biemna chilensis, Thiele.
Polymastia invaginata, Kirkpatrick.
Stylocordyla borealis, subsp. *acuata*, Kirkpatrick.

St. 179. 10. iii. 27. Melchior Island, Schollaert Channel, Palmer Archipelago. In creek to SW of anchorage. Small dredge, rock, 4–10 m.

Iophon radiatus, Topsent.

St. 180. 11. iii. 27. 1·7 miles W of N point of Gand Island, Schollaert Channel, Palmer Archipelago. Large dredge, mud and stones, 160–330 m.

Rossella villosa, Burton.
Haliclonissa verrucosa, sp.n.
Adocia cucurbitiformis (Kirkpatrick).
Tedania massa, Ridley and Dendy.

St. 181. 12. iii. 27. Schollaert Channel Palmer Archipelago, 64° 20′ S, 63° 01′ W. Large otter trawl, mud, 160–335 m.

Gymnorossella inermis, Topsent.
Haliclona penicillata (Topsent).
Tedania massa, Ridley and Dendy.
Myxilla mollis, Ridley and Dendy.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W. Large dredge, mud, 259 m.

Rossella antarctica, var. *intermedia*, n.
Cercidochela lankesteri, Kirkpatrick.
Biemna chilensis, Thiele.
Axociella nidificata (Kirkpatrick).
Polymastia isidis, Thiele.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 64° 56′ S, 63° 35′ W. Large dredge, rock or stones and mud, 93–130 m.

Rossella antarctica, var. *intermedia*, n.
R. nuda, Topsent.
R. racovitzae, Topsent.
R. villosa, Burton.
Gymnorossella inermis, Topsent.
Plakina trilopha, Schulze.
Microxina benedeni (Topsent).
Adocia glacialis (Ridley and Dendy).
Isodictya setifer (Topsent).
I. cactoides (Kirkpatrick).
I. erinacea (Topsent).
I. toxophila, sp.n.
Myxilla australis, Topsent.
Ectyodoryx frondosa, var. *anacantha*, Hentschel.
Clathria toxipraedita, Topsent.
Axociella nidificata (Kirkpatrick).
Eurypon miniaceum, Thiele.
Rhizaxinella australiensis, Hentschel.
Suberites papillatus, Kirkpatrick.
S. microstomus, var. *stellatus*, Kirkpatrick.
Stylocordyla borealis, subsp. *acuata*, Kirkpatrick.

St. 222. 23. iv. 27. St Martin's Cove, Hermite Island, Cape Horn. Large rectangular net, 70–75 m.

Tedania spinata (Ridley).
Halisarca dujardini, var. *magellanica*, Topsent.

(The specimens obtained from St. 222 appear to be all detached. Those of *Tedania spinata* are without visible means of attachment and *Halisarca dujardini*, var. *magellanica* is seated on a piece of *Fucus* (?).)

St. 271. 28–30. vii. 27. Elephant Bay, Angola. Shore collecting.

Hymeniacidon sanguinea (Grant).

St. 283. 14. viii. 27. Off Annobon, Gulf of Guinea, 0·75 to 1 mile N 12° E of Pyramid Rock, Annobon. Large dredge, 18–30 m.

Stylohalina hirta (Topsent).
Bubaris vermiculata (Bowerbank).
Spirastrella purpurea (Lamarck).
Cliona aethiopicus, sp.n.

R.S.S. 'WILLIAM SCORESBY'

St. WS 25. 17. xii. 26. Undine Harbour (North), South Georgia. Small beam trawl, mud and sand, 18–27 m.

Ophlitaspongia thielei, sp.n.

St. WS 27. 19. xii. 26. South Georgia, 53° 55′ S, 38° 01′ W. 1 m. tow-net (touched bottom), gravel, 106–109 m.

Tetilla leptoderma (Sollas).
Haliclona bilamellata, sp.n.
Isodictya toxophila, sp.n.
Plumohalichondria maeandrina (Kirkpatrick).
Tedania charcoti, Topsent.
Myxilla mollis, Ridley and Dendy.
M. australis (Topsent).
M. basimucronata, sp.n.
Kirkpatrickia variolosa (Kirkpatrick).
Stylotellopsis amabilis, Thiele.
Hymeniacidon fernandezi, Thiele.

St. WS 33. 21. xii. 26. South Georgia 54° 59′ S, 35° 24′ W. 1 m. tow-net (touched bottom), grey mud and stones, 130 m.

Grantia cirrata, var. *aurorae*, Dendy.
Cinachyra barbata, Sollas.
Plumocolumella maeandrina (Kirkpatrick).
Iophon radiatus, Topsent.
Clathria toxipraedita, Topsent.
Hymedesmia simillima, var. *antarctica*, Hentschel.

St. WS 42. 7. i. 26. South Georgia, 54° 41′ 45″ S, 36° 47′ W. 1 m. tow-net, grey mud and stones, 198 m.

Cinachyra barbata, Sollas.
Tedania charcoti, Topsent.
Myxilla mollis, Ridley and Dendy.
M. basimucronata, sp.n.
Plocamia gaussiana, Hentschel.

St. WS 62. 19. i. 27. Wilson Harbour, South Georgia. Small beam trawl, 15–45 m.

Homaxinella supratumescens (Topsent).

St. WS 72. 5. iii. 27. Falkland Islands, 51° 07′ S, 57° 34′ W. Commercial otter trawl, sand and shell, 79 m.

Callyspongia fortis (Ridley).
Tedania spinata (Ridley).

St. WS 73. 6. iii. 27. Falkland Islands, 51° 01′ S, 58° 54′ W. Tow-net attached to trawl, fine dark sand, 121 m.

Dasychalina validissima (Thiele).
Isodictya setifer (Topsent).
I. antarctica (Kirkpatrick).
Mycale magellanica (Ridley).
Tedania tenuicapitata, Ridley.

St. WS 75. 10. iii. 27. Falkland Islands, 51° 01′ 30″ S, 60° 31′ W. Commercial otter trawl, 72 m.

Tedania spinata (Ridley).

St. WS 76. 11. iii. 27. Falkland Islands, 51° 00′ S, 62° 02′ 30″ W. Commercial otter trawl, fine dark sand, 205–207 m.

Dasychalina validissima (Thiele).
Tedania tenuicapitata, Ridley.
T. spinata (Ridley).
Myxilla mollis, Ridley and Dendy.

St. WS 77. 12. iii. 27. Falkland Islands, 51° 01′ S, 66° 31′ 30″ W. Commercial otter trawl, coarse dark sand, 110–113 m.

Dasychalina validissima (Thiele).
Callyspongia fusifera (Thiele).
Isodictya setifer (Topsent).
Tedania spinata (Ridley).

St. WS 79. 13. iii. 27. Falkland Islands, 51° 01′ 30″ S, 64° 59′ 30″ W. Commercial otter trawl, fine dark sand, 131–132 m.

Isodictya kerguelensis (Ridley and Dendy).
Guitarra fimbriata, Carter.
Plumocolumella myxillioides, sp.n.
Tedania tenuicapitata, Ridley.
T. spinata (Ridley).
Myxilla mollis, Ridley and Dendy.
Extyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
Dictyociona discreta (Thiele).
Halisarca dujardini, var. *magellanica*, Topsent.

St. WS 80. 14. iii. 27. Falkland Islands, 50° 57′ S, 63° 37′ 30″ W. Net of 7 mm. mesh attached to trawl, fine dark sand, 152–156 m.

Plakina trilopha, Schulze.
Isodictya setifer (Topsent).
Plumocolumella myxillioides, sp.n.
Tedania massa, Ridley and Dendy.
T. spinata (Ridley).

St. WS 81. 19. iii. 27. 8 miles N 11° W of North Island, West Falkland Island. Commercial otter trawl and net of 7 mm. mesh attached to trawl, sand, 81–82 m.

Geodia magellani (Sollas).
Microxina benedeni (Topsent).
Adocia carduus (Ridley and Dendy).
Callyspongia flabellata, sp.n.
Isodictya setifer (Topsent).
Plumocolumella myxillioides, sp.n.
Tedania massa, Ridley and Dendy.
Clathria papillosa, Thiele.
Raspaxilla phakellina, Topsent.
Polymastia isidis, Thiele.
Latrunculia lendenfeldi, Hentschel.

St. WS 82. 21. iii. 27. Falkland Islands, 51° 30′ S, 61° 15′ W. Commercial otter trawl, 140–144 m.

Adocia glacialis (Ridley and Dendy).
Gellius fibulatus (Schmidt).
Mycale magellanica (Ridley).
Tedania massa, Ridley and Dendy.
Ectyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
Axinella crinita, Thiele.
Polymastia isidis, Thiele.

St. WS 83. 24. iii. 27. 14 miles S 64° W of George Island, East Falkland Island. Commercial otter trawl, fine green sand and shell, 137–129 m.

Haliclona bilamellata, sp.n.
Adocia carduus (Ridley and Dendy).
A. glacialis (Ridley and Dendy).
Dasychalina validissima (Thiele).
Callyspongia fortis (Ridley).
Isodictya setifer (Topsent).
I. antarctica (Kirkpatrick).
Plumocolumella myxillioides, sp.n.
Mycale magellanica (Ridley).
Amphilectus fucorum (Johnston).
Iophon radiatus, Topsent.
I. proximum (Ridley).
Tedania tenuicapitata, Ridley.
T. massa, Ridley and Dendy.
T. spinata (Ridley).
Myxilla mollis, Ridley and Dendy.
Ectyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
Inflatella belli (Kirkpatrick).
Clathria papillosa, Thiele.
Rhaphidophlus paucispiculus, sp.n.
Stylotellopsis amabilis, Thiele.
Hymeniacidon dubia, sp.n.
Plicatellopsis arborescens, sp.n.
Latrunculia lendenfeldi, Hentschel.

St. WS 84. 24. iii. 27. 7½ miles S 9° W of Sea Lion Island, East Falkland Island. Commercial otter trawl, coarse sand, shells and stones, 75–74 m.

Leucetta leptorhaphis (Jenkin).
Leucettusa haeckeliana (Poléjaeff).
L. simplicissima, sp.n.
Haliclona chilensis (Thiele).
Dasychalina validissima (Thiele).
Callyspongia fortis (Ridley).
Myxilla mollis, Ridley and Dendy.
Anchinoë latrunculioides (Ridley and Dendy).
Clathria papillosa, Thiele.
Rhaphidophlus paucispiculus, sp.n.
Raspaxilla phakellina, Topsent.
Hymeniacidon fernandezi, Thiele.
Plicatellopsis flabellata, sp.n.
Latrunculia lendenfeldi, Hentschel.
Spongia magellanica, Thiele.
Duseideia chilensis (Thiele).

St. WS 85. 25. iii. 27. Falkland Islands, 52° 09′ S, 58° 14′ W. Commercial otter trawl with nets of 4 and 7 mm. mesh attached, sand and shell, 79 m.

Grantia cirrata, var. *tenuipilosa*, n.
Amphilectus rugosus (Thiele).
Iophon proximum (Ridley).
Tedania tenuicapitata, Ridley.
Hymeniacidon fernandezi, Thiele

St. WS 86. 3. iv. 27. Falkland Islands, 53° 53′ 30″ S, 60° 34′ 30″ W. Commercial otter trawl, sand, shell and stones, 151–147 m.

Haliclona bilamellata, sp.n.
Callyspongia fortis (Ridley).
C. fusifera (Thiele).
Isodictya microchela (Topsent).
Guitarra fimbriata, Carter.
Plumocolumella myxillioides, sp.n.
Ectyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
Pseudosuberites sulcatus, Thiele.
Polymastia isidis, Thiele.

St. WS 87. 3. iv. 27. Falkland Islands, 54° 07′ 30″ S, 58° 16′ W. Commercial otter trawl, sand, shell and stones, 96–127 m.

Haliclona bilamellata, sp.n.
Mycale magellanica (Ridley).
Tedania massa, Ridley and Dendy.

St. WS 88. 6. iv. 27. Falkland Islands, 54° 00′ S, 64° 57′ 30″ W. Commercial otter trawl, sand, shell and stones, 96–127 m.

Adocia tenellus (Topsent).
Isodictya setifer (Topsent).
Plumocolumella myxillioides, sp.n.
Amphilectus flabellata, sp.n.
Tedania tenuicapitata, Ridley.
T. massa, Ridley and Dendy.
T. spinata (Ridley).
Myxilla mollis, Ridley and Dendy.
Stelodoryx discovereyi, sp.n.
Clathria papillosa, Thiele.
Latrunculia lendenfeldi, Hentschel.

St. WS 89. 7. iv. 27. Falkland Islands, 9 miles N 21° E of Arenas Point Light, Tierra del Fuego. Commercial otter trawl, mud, gravel and stones, 23–21 m.

Tedania tenuicapitata, Ridley.
Spongia magellanica, Thiele.

St. WS 90. 7. iv. 27. 13 miles N 83° E of Cape Virgins Light, Argentine Republic. Commercial otter trawl, fine dark sand, 82–81 m.

Mycale magellanica (Ridley).
Stelodoryx discovereyi, sp.n.
Pseudosuberites sulcatus, Thiele.

St. WS 91. 8. iv. 27. Tierra del Fuego, 52° 53′ 45″ S, 64° 37′ 30″ W. Commercial otter trawl, fine dark sand and shell, 191–205 m.

Tedania spinata (Ridley)
Pseudosuberites sulcatus, Thiele.

St. WS 93. 9. iv. 27. West Falkland Island, 51° 51′ S, 61° 30′ W. Commercial otter trawl, grey sand, 133–130 m.

Tedania massa, Ridley and Dendy.

St. WS 95. 17. iv. 27. Falkland Islands, 48° 58′ 15″ S, 64° 45′ W. Commercial otter trawl, fine dark sand and stones, 108–109 m.

Tedania spinata (Ridley).
Clathria papillosa, Thiele.
Dictyociona discreta (Thiele).

St. 101. 23. iv. 27. Falkland Islands, 50° 27′ S, 62° 06′ W. 70 cm. tow-net, 150–100 m.

Gymnorossella inermis, Topsent.

St. 102. 23. iv. 27. Falkland Islands, 50° 05′ S, 62° 37′ W. 70 cm. tow-net, 100–50 m.

Gymnorossella inermis, Topsent.

St. WS 99. 19. iv. 27. Falkland Islands, 49° 42′ S, 59° 14′ 30″ W. Commercial otter trawl, fine dark sand, 251–225 m.

Haliclona bilamellata, sp.n.
Microxina benedeni (Topsent).
Isodictya setifer (Topsent).
Tedania tenuicapitata, Ridley.
T. massa, Ridley and Dendy.
Myxilla mollis, Ridley and Dendy.

St. WS 108. 25. iv. 27. Falkland Islands, 48° 30′ 45″ S, 63° 33′ 45″ W. Commercial otter trawl, fine dark sand, 118–120 m.

Haliclona penicillata (Topsent).
Tedania spinata (Ridley).
Pseudosuberites sulcatus, Thiele.

St. WS 109. 26. iv. 27. Falkland Islands, 50° 18′ 48″ S, 58° 28′ 30″ W. Commercial otter trawl, fine dark sand, 145 m.

Dasychalina validissima (Thiele).
Isodictya kerguelensis, var. *simillima* (Hentschel).
I. setifer (Topsent).
I. delicata (Thiele).
Tedania massa, Ridley and Dendy.
T. spinata (Ridley).
Rhaphidophlus paucispiculus, sp.n.
Artemisina plumosa, Hentschel.

St. WS 128. 10. vi. 27. W side of Gough Island, inshore. Large dredge, 120–90 m.

Iophon proximum (Ridley).

St. WS 177. 7. iii. 28. South Georgia, 54° 58′ S, 35° 00′ W. 1 m. tow-net (touched bottom), 97 m.

Mycale magellanica (Ridley).

St. WS 210. 29. v. 28. Falkland Islands, 50° 17′ S, 60° 06′ W. Commercial otter trawl, green sand, 161 m.

Hemigellius pachyderma, sp.n.
Mycale magellanica (Ridley).
Tedania spinata (Ridley).

St. WS 213. 30. v. 28. Falkland Islands, 49° 22′ S, 60° 10′ W. Commercial otter trawl, green sand, mud and pebbles, 249–239 m.

Mycale magellanica (Ridley).

St. WS 216. 1. vi. 28. N of Falkland Islands, 47° 37′ S, 60° 50′ W. Commercial otter trawl, fine sand, 219–133 m.

Tedania massa, Ridley and Dendy.

St. WS 218. 2. vi. 28. N of Falkland Islands, 45° 45′ S, 59° 35′ W. Commercial otter trawl, dark sand, 311–247 m.

Tetilla leptoderma (Sollas).

St. WS 222. 8. vi. 28. Falkland Islands, 48° 23′ S, 65° 00′ W. Commercial otter trawl, coarse brown sand, 100–106 m.

Mycale magellanica (Ridley).
Tedania spinata (Ridley).

St. WS 223. 8. vi. 28. NE of Falkland Islands, 49° 13′ S, 64° 52′ W. Commercial otter trawl, coarse brown sand, 114 m.

Haliclonissa sacciformis, sp.n.
Guitarra fimbriata, Carter.

St. WS 225. 9. vi. 28. Falkland Islands, 50° 20′ S, 62° 30′ W. Commercial otter trawl, green sand, shells and pebbles, 162–161 m.

Rossella racovitzae, Topsent.
Gymnorossella inermis, Topsent.
Tetilla leptoderma (Sollas).
Mycale magellanica (Ridley).
Tedania massa, Ridley and Dendy.
T. spinata (Ridley).
Myxilla mollis, Ridley and Dendy.
Ectyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
Hymedesmia simillima, var. *antarctica*, Hentschel.
Rhizaxinella australiensis, Hentschel.

St. WS 229. 1. vii. 28. Falkland Islands, 50° 35′ S, 57° 20′ W. Net of 4 mm. mesh attached to trawl, fine green sand, 210–271 m.

Amphilectus fucorum (Esper).

St. WS 231. 4. vii. 28. Falkland Islands, 50° 10′ S, 58° 42′ W. Commercial otter trawl, fine green sand, 167–159 m.

Tedania massa, Ridley and Dendy.

St. WS 233. 5. vii. 28. Falkland Islands, 49° 25′ S, 59° 45′ W. Commercial otter trawl, fine green sand, 185–175 m.

Dasychalina validissima (Thiele).
Mycale magellanica (Ridley).

St. WS 237. 7. vii. 28. N of Falkland Islands, 46° 00′ S, 60° 05′ W. Commercial otter trawl, coarse brown sand and shells, 150–256 m.

Dasychalina validissima (Thiele).
Pseudanchinoë toxifera (Topsent).

St. WS 239. 15. vii. 28. Falkland Islands, 51° 10′ S, 62° 10′ W. Commercial otter trawl, coarse dark sand, 196–193 m.

Rossella nuda, Topsent.
Isodictya setifer (Topsent).
Mycale magellanica (Ridley).
Tedania tenuicapitata, Ridley.
T. spinata (Ridley).
Myxilla mollis, Ridley and Dendy.
Ectyodoryx paupertas, subsp. *nobile* (Ridley & Dendy).
Suberites montiniger (Carter).

St. WS 243. 17. vii. 28. NE of Falkland Islands, 51° 06′ S, 64° 30′ W. Commercial otter trawl and net of 4 mm. mesh attached, coarse dark sand, 144–141 m.

Leucettusa haeckeliana (Poléjaeff).
Tetilla leptoderma (Sollas).
Haliclona tubuloramosa (Dendy).
H. conica (Brøndsted).
H. bilamellata, sp.n.
Dasychalina validissima (Thiele).
Isodictya setifer (Topsent).
Guitarra fimbriata, Carter.
Plumocolumella myxillioides, sp.n.
Biemna chilensis, Thiele.
Tedania tenuicapitata, Ridley.
T. massa, Ridley and Dendy.
T. spinata (Ridley).
Myxilla verrucosa, sp.n.
Ectyodoryx paupertas, subsp. *nobile* (Ridley and Dendy).
Anchinoë latrunculioides (Ridley and Dendy).
Stelodoryx pluridentata (Lundbeck).
Dictyociona discreta (Thiele).
Clathria toxipraedita, Topsent.
Plicatellopsis arborescens, sp.n.
Pseudosuberites hyalinus (Ridley and Dendy).
Latrunculia lendenfeldi, Hentschel.
Duseideia tenuifibra, sp.n.

St. WS 244. 18. vii. 28. Falkland Islands, 52° 00′ S, 62° 40′ W. Commercial otter trawl, fine dark sand and mud, 253–247 m.

Mycale magellanica (Ridley).
Tedania massa, Ridley and Dendy.
Myxilla mollis, Ridley and Dendy.

St. WS 246. 19. vii. 28. Falkland Islands, 52° 25′ S, 61° 00′ W. Commercial otter trawl, coarse green sand and pebbles, 267–208 m.

Isodictya setifer (Topsent).
Plumocolumella myxillioides, sp.n.
Mycale magellanica (Ridley).
Tedania tenuicapitata, Ridley.
T. massa, Ridley and Dendy.
Myxilla mollis, Ridley and Dendy.
Latrunculia lendenfeldi, Hentschel.

St. WS 247. 19. vii. 28. Falkland Islands, 52° 40′ S, 60° 05′ W. Large dredge, rock, 172 m.

Haliclona bilamellata, sp.n.
Mycale magellanica (Ridley).
Iophon proximum (Ridley).
Myxilla mollis, Ridley and Dendy.
Ectyodoryx paupertas, subsp. *nobile* (Ridley and Dendy).

St. WS 248. 20. vii. 28. Falkland Islands, 52° 40′ S, 58° 30′ W. Commercial otter trawl, fine green sand, pebbles and shells, 210–242 m.

Rossella racovitzae, Topsent.
Microxina benedeni (Topsent).
Isodictya setifer (Topsent).
Plumocolumella myxillioides, sp.n.
Mycale magellanica (Ridley).
M. lapidiformis (Ridley and Dendy).
Tedania tenuicapitata, Ridley.
T. massa, Ridley and Dendy.
Inflatella belli (Kirkpatrick).
Polymastia isidis, Thiele.
Latrunculia lendenfeldi, Hentschel.

St. WS 249. 20. vii. 28. Falkland Islands, 52° 10′ S, 57° 30′ W. Large dredge, fine brown and green sand, shells and stones, 166 m.

Mycale magellanica (Ridley).
Tedania spinata (Ridley).
Ectyodoryx paupertas, subsp. *nobile* (Ridley and Dendy).

St. WS 250. 20. vii. 28. Falkland Islands, 51° 45′ S, 57° 00′ W. Commercial otter trawl, fine green sand, 251–313 m.

Gymnorossella inermis, Topsent.
Mycale magellanica (Ridley).
Tedania tenuicapitata, Ridley.
T. massa, Ridley and Dendy.
Myxilla mollis, Ridley and Dendy.
Polymastia isidis, Thiele.

MARINE BIOLOGICAL STATION

St. MS 14. 17. ii. 25. From 1·5 miles SE by S to 1·5 miles S ½° W of Sappho Point, East Cumberland Bay. Small dredge, 190–110 m.

Homaxinella supratumescens (Topsent).

St. MS 68. 2. iii. 26. East Cumberland Bay, South Georgia, from 1·7 miles S ½° E to 8½ cables SE by E of Sappho Point. Large rectangular net, 220–247 m.

Rossella nuda, Topsent.
Isodictya cactoides (Kirkpatrick).

St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, from 9¼ cables E by S to 1·2 miles E by S of Sappho Point. Small beam trawl, 120–60 m.

Cinachyra barbata, Sollas.
Mycale tridens, Hentschel.
Myxilla mollis, Ridley and Dendy.

Saldanha Bay, South-west Africa (beach).

Haliclona stephensi, sp.n.
Hymeniacidon caruncula, Bowerbank.

DESCRIPTIONS OF SPECIES

Phylum **NUDA**

Order **HEXACTINELLIDA**

Family **ROSSELLIDAE**

Genus **Rossella**, Carter

Rossella antarctica, var. intermedia, n. (Fig. 3 *b*, p. 257).

Occurrence. St. 42: South Georgia, 120–204 m.; St. 152: South Georgia, 245 m.; St. 156: South Georgia, 200–236 m.; St. 175: South Shetlands, 200 m.; St. 187: Palmer Archipelago, 259 m.; St. 190: Palmer Archipelago, 93–130 m.

REMARKS. The six specimens present are all immature forms obtained from South Georgia and the South Shetlands. The smallest is about 1 cm. in diameter and the largest no more than 7 cm. high. In most respects they are quite typical of the species, but their method of attachment leads to a number of interesting considerations. Two of the specimens have the normal tuft of basalia, a third is without the basal half of the sponge, and the three remaining are without basalia but have anchored themselves to pieces of black volcanic rock.

Two forms of *R. antarctica* have been known hitherto, var. *antarctica* from the Antarctic and var. *solida* from the Kerguelen region. In the present group of specimens we have a third variety which is intermediate between these two, suggesting that they are no more than geographical varieties of a single species. The main differences between the var. *antarctica* and the var. *solida* are that in the former there is invariably (?) a basal tuft, that the velum is more strongly developed and that the rays of the pentactin pleuralia are more or less cruciform; whereas in the latter, the sponge is always attached directly to the substratum, the velum is but feebly developed and the rays of the pentactin pleuralia are confined to a sector of about 140° (Fig. 3 *b*). The present specimens are completely intermediate between the two older varieties in these three distinguishing features: the sponge may have a basal tuft or may be attached directly to the substratum, the velum is moderately well developed (in one specimen it is present on one side of the sponge and completely absent on the other, although the diactin pleuralia are equally well developed all over), and the rays of the pentactin pleuralia are confined usually to a sector of 180°.

With regard to the question whether a species which normally has a basal tuft may be represented by specimens attached directly to the substratum (cf. Kirkpatrick, 1907, p. 6), the present specimens contribute some relevant data. The individuals of var. *intermedia* seem to be able equally well to produce a basal tuft or to attach themselves direct, and there is evidence that the same thing is true, though perhaps to a lesser extent, in *R. nuda*, Topsent, and *R. racovitzae*, Topsent (*q.v.*).

One of the specimens is a "twin", recalling the specimen of var. *solida* originally described by Schulze (1887) from Kerguelen.

Among the specimens from St. 156 is a small bundle of pentactin pleuralia from an individual of var. *intermedia* bearing a bud about 3 mm. in length. The presence of this bud in a jar which included, together with non-Hexactinellid sponges, only a small specimen of the present variety, suggests that it was found free and had not been accidentally torn away from a larger, budding specimen. If correct, this surmise offers an explanation as to how the buds of *R. antarctica*, which migrate along the shafts of the pentactin pleuralia, get over the obstacle offered by the rays at the ends of the pleuralia. Presumably the pentacts bearing the buds are shed and the buds thus released.

Rossella nuda, Topsent (Figs. 1, 2).

(For synonymy see Burton, 1929, p. 409.)

Occurrence. St. 39: South Georgia, 179–235 m.; St. 45: South Georgia, 238–270 m.; St. 123: South Georgia, 230–250 m.; St. 148: South Georgia, 132–148 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 239: Falkland Islands, 196–193 m.; St. MS 68: South Georgia, 220–247 m.

REMARKS. The several specimens, only three of which are dry, range in size from a few cm. to 77 cm. high, and show all the variations illustrated by me (1929, p. 406, text-fig. 1), including that of the *hodgsoni* form. Of the specimens from St. 190, one is fragmentary and the other is a "twin" (cf. *R. antarctica*, var. *intermedia*) 14 cm. high and very like the holotype of "*Aulorossella levis*". The specimens from Sts. 39 and MS 68 consist of papillae torn from the surfaces of large specimens of the *c*-form.[1] The specimen from St. 148 is sub-spherical, 10 cm. high, with surface almost apapillose, but with strongly developed bundles of pleuralia projecting from the surface. There are only vestiges of a root-tuft and the base is truncate with small pebbles, etc., buried in its outer tissues. This specimen combines the sub-spherical shape of both the *a*-form and the *c*-form, the surface of the *b*-form, and, in having no root-tuft, it approximates also to both the *e*-form and the *f*-form. The specimen from St. 123 is cylindrical, 14 cm. high and 5 cm. in diameter, with slightly papillose surface beset with feeble bundles of pleuralia.

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[1] These letters correspond to the letters given in my Terra Nova Report, 1929, text-fig. 2.

It is pedunculate, without root-tuft, and still bears at its base a portion of the black rock on which it was growing.

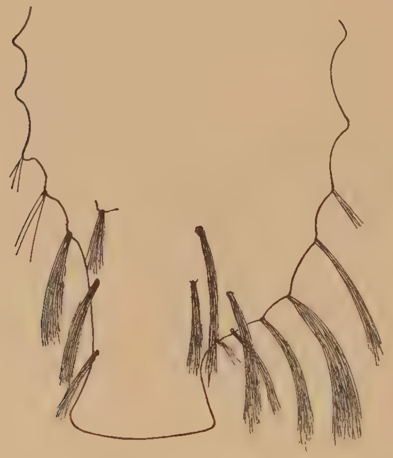

Fig. 1. *Rossella nuda*, Topsent. Base of a specimen from St. 123, with basal tuft and an incipient stalk. × $\frac{3}{8}$.

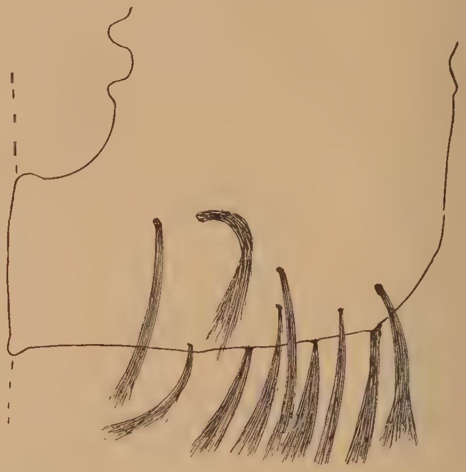

Fig. 2. *Rossella nuda*, Topsent. A second specimen showing the same features, but with the stalk placed laterally.

The next three specimens are dried. The first is cylindrical, 75 cm. high by 30 cm. in diameter, with only a scanty root-tuft as in the *d*-form. The lower two-thirds of the sponge is covered with numerous well-developed papillae without projecting pleuralia, but on the upper third the papillae are scarce. They are often as much as 5 cm. high and may be bifid, or even trifid. In this sponge, then, are combined the characters of the *b*-, *c*- and *d*-forms. The second specimen, 22 cm. high and 9 cm. in diameter, is completely covered with small papillae devoid of projecting pleuralia, and with the basalia segregated into sparse bundles as in the *d*-form. The basalia are few in number and feebly developed, recalling the condition found in the *e*- and *f*-forms. The chief interest of this specimen is, however, the fact that the sponge was probably attached directly by its base, and did not rely on its basal tuft although it is slightly developed, since this is continued downwards as a short stalk (Fig. 1). But, judging by the appearance of the base, and by the presence of numerous small fragments of black rock embedded in the outer tissues, it was not attached to a rock but buried in the mud. The third specimen is very similar to the foregoing, is 30 cm. high and 17 cm. in diameter, completely covered with papillae and bears sparse bundles of basalia. This sponge appears to have been attached by a laterally placed basal plate (Fig. 2).

DISTRIBUTION. South Georgia; Graham Land; Victoria Land; Wilhelm Land.

Rossella racovitzae, Topsent.

(For synonymy see Burton, 1929, p. 407.)

Occurrence. St. 160: near Shag Rocks, 177 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 225: Falkland Islands, 162–161 m.; St. WS 248: Falkland Islands, 210–242 m.

REMARKS. Of the two small specimens, the larger, 3 cm. high by 2 cm. in diameter, has a distinct basal tuft; but the smaller, less than 5 mm. in diameter, has no recognizable tuft and is fixed by the base to a Serpulid tube.

DISTRIBUTION. South Orkneys; Graham Land; Victoria Land; Wilhelm Land.

Rossella villosa, Burton.

R. villosa, Burton, 1929, p. 412, pl. iii.

Occurrence. St. 180: Palmer Archipelago, 160–330 m.; St. 190: Palmer Archipelago, 93–130 m.

REMARKS. There are two immature specimens, the largest 5 cm. high, which appear to belong to this species; but since the basalia are missing in each it is impossible to be quite certain of the identification, especially as they resemble the young forms of *R. nuda*, Topsent, in many ways.

DISTRIBUTION. Victoria Land.

Genus **Gymnorossella**, Topsent

Gymnorossella inermis, Topsent (Fig. 3 *d–g*).

G. inermis, Topsent, 1916, p. 164; *id.*, 1917, p. 22, pl. i, fig. 1, pl. v, fig. 4; Burton, 1929, p. 413.

Occurrence. St. 181: Palmer Archipelago, 160–335 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 101: Falkland Islands, 100–150 m.; St. WS 102: Falkland Islands, 50–100 m.; St. WS 225: Falkland Islands, 162–161 m.; St. WS 250: Falkland Islands, 251–313 m.

REMARKS. The larger of the two specimens is 20 cm. high and both agree closely with the holotype. The only point worth noting here is the variation in the angles of the rays of the pentactin basalia. In the larger specimen (from St. 181) these are all disposed within an angle of less than 180°; in the second specimen they vary a good deal, and although in most of the basalia the rays are confined within an angle of less than 180°, some are cruciform (Fig. 3 *d–g*) and there are all intermediates.

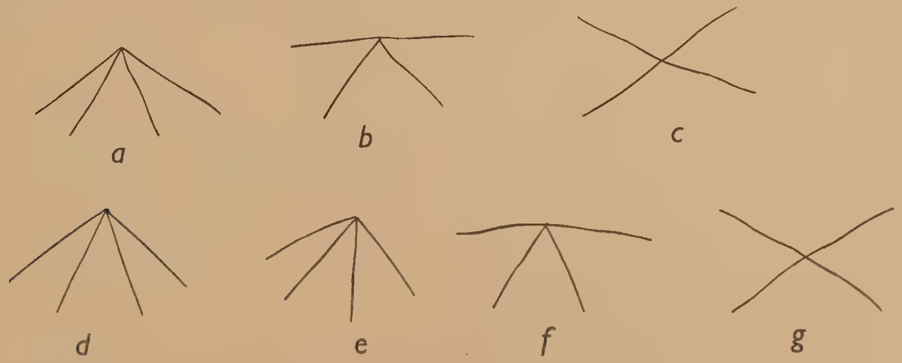

Fig. 3. Showing variation in rays of pentactin, pleuralia and basalia: *a*, *Rossella antarctica solida*; *b*, *R. antarctica intermedia*; *c*, *R. antarctica antarctica*; *d–g*, *Gymnorossella inermis*.

DISTRIBUTION. Graham Land.

Phylum GELATINOSA

Order CALCAREA

Family HOMOCOELIDAE

Genus **Leucosolenia**, Bowerbank

Leucosolenia macleayi (Lendenfeld).

(For synonymy see Burton, 1930, p. 14.)

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

Remarks. Two small stipitate sponges, about 12 mm. in height and with a stalk 7 mm. long, with the typical external form. In the spicules the basal ray measures 0·09 mm. and the lateral rays 0·045 mm.

Distribution. Practically cosmopolitan.

Leucosolenia discovereyi, Jenkin.

L. discovereyi, Jenkin, 1908, p. 6, pl. xxviii, figs. 12, 13.

Occurrence. St. 53: Falkland Islands, 0–2 m.

Remarks. Numerous small specimens growing among Hydroids on a *Mytilus* shell.

Distribution. Victoria Land.

Family LEUCASCIDAE

Genus **Pericharax**, Poléjaeff

Pericharax pyriformis, sp.n. (Plate XLVIII, figs. 1, 2).

Holotype. B.M. 28. 2. 15. 36.

Occurrence. St. 160: Shag Rocks, 177 m.

Diagnosis. Sponge pyriform, with single apical oscule; skeleton a mixture of large and small triradiates in chamber layer, with a dermal skeleton of triradiates, a gastral skeleton of quadriradiates and oscular skeleton of quadriradiates.

Remarks. This is a typical *Pericharax*, the skeleton of which closely resembles those of both *P. heteroraphis* and *P. peziza*, but which differs from both in the external form. The three specimens representing this species are all pyriform, with a single apical oscule which leads out from a shallow cloaca bearing in its walls the openings of the main exhalant canals. The surface is slightly uneven and rough to the touch. The colour, in spirit, is a greyish white. The largest specimen, the holotype, measures 2 cm. high and 1·5 cm. across the broadest part. The diameter of the oscule is 2 mm.

Spicules. (1) Large triradiates of the main skeleton, equiangular and equiradiate, rays straight but gradually and sharply pointed, measuring up to 1·2 mm. long and 0·096 mm. thick at the base.

(2) Small triradiates of the main skeleton, equiangular and equiradiate, with straight rays measuring up to 0·24 mm. long by 0·015 mm. thick at the base.

(3) Triradiates of the dermal skeleton slightly irregular and arranged tangentially to the surface, each ray about 0·24 mm. long.

(4) Quadriradiates of the oscular margin sagittal with facial rays 0·105 mm. long and apical rays 0·12 mm. long.

(5) Quadriradiates of the gastral cortex and larger exhalant canals, of similar dimensions to (4) but not sagittal.

Genus **Leucetta**, Haeckel

Leucetta leptoraphis (Jenkin).

Leucandra primigenia, var. *leptoraphis*, Jenkin, 1908, p. 14, pl. xxix, figs. 33, 34; *Leucetta antarctica*, Dendy, 1918, p. 8, pl. i, figs. 2–7; *L. leptoraphis*, Burton, 1929, p. 404, pl. v, figs. 1–4.

Occurrence. St. 39: South Georgia, 179–235 m.; St. 42: South Georgia, 120–204 m.; (St. 84: 32° S, 1° E, 75–74 m.; there is evidently a doubt about this station which should probably be Palmer Archipelago, St. 190); St. 140: South Georgia, 122–136 m.; St. 148: South Georgia, 132–148 m.; St. WS 84: Falkland Islands, 75–74 m.

REMARKS. Some ten specimens are present agreeing with the holotype in spiculation and showing the same range in external form as that to which I have drawn attention in my Terra Nova report (*loc. cit.*).

DISTRIBUTION. Victoria Land.

Leucetta macquariensis, Dendy.

L. macquariensis, Dendy, 1918, p. 9, pl. i, figs. 3, 8.

Occurrence. St. 53: Falkland Islands, 0–2 m.; St. 55: Falkland Islands, 10–16 m.; St. 56: Falkland Islands, 10½–16 m.; St. 145: South Georgia, 26–35 m.; St. 156: South Georgia, 200–236 m.

REMARKS. There are considerable differences between the individuals of this species as regards the large oxea and the microxea. One or other of these types of spicules may be sparingly present or even entirely absent, and but for the fact that they are never both absent altogether, the task of identification would present some difficulty. Even so, it is easy to imagine that single specimens examined alone might conceivably be placed in a different species, owing to the absence of one or other of these spicules, and it is quite possible that the case may yet arise in which an individual will be found to have lost both sets of spicules entirely.

DISTRIBUTION. Macquarie Island.

Family LEUCALTIDAE

Genus **Leucaltis**, Haeckel

Leucaltis gastrorhabdifera, sp.n. (Figs. 4, 5).

Holotype. B.M. 28. 2. 15. 833.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

DIAGNOSIS. Sponge erect, tubular, without oscular fringe; surface very minutely and sparingly hispid; skeleton composed of a dermal layer of triradiates, with large sagittal quadriradiates forming skeleton of chamber layer and a layer of large rhabds immediately beneath gastral surface; rhabds similar to those of gastral layer found projecting, sparingly, from dermal surface; triradiates of dermal tangential layer, equiangular and equiradiate, rays 0·18 by 0·01 mm.; quadriradiates of chamber layer, apical rays 0·18 by 0·01 mm. and basal rays 0·28 to 0·42 by 0·024 mm.; rhabds 0·59 by 0·022 mm.

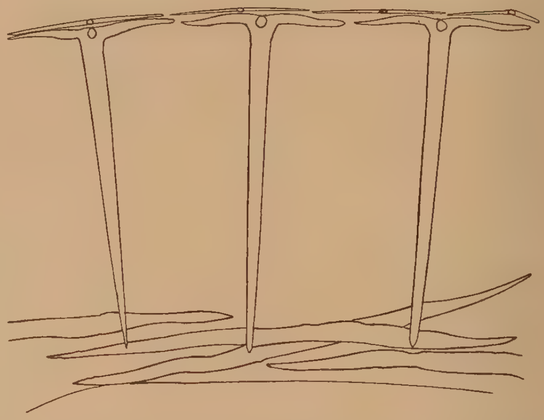

Fig. 4. *Leucaltis gastrorhabdifera*, sp.n. Section of body wall to show arrangement of skeleton (semi-diagrammatic).

REMARKS. The holotype is no more than 1 cm. high and 2 mm. in diameter. To have described adequately the spicules of the oscular margin, according to custom, would have meant the total destruction of the specimen, and since these spicules are not of diagnostic importance, no attempt has been made to examine them.

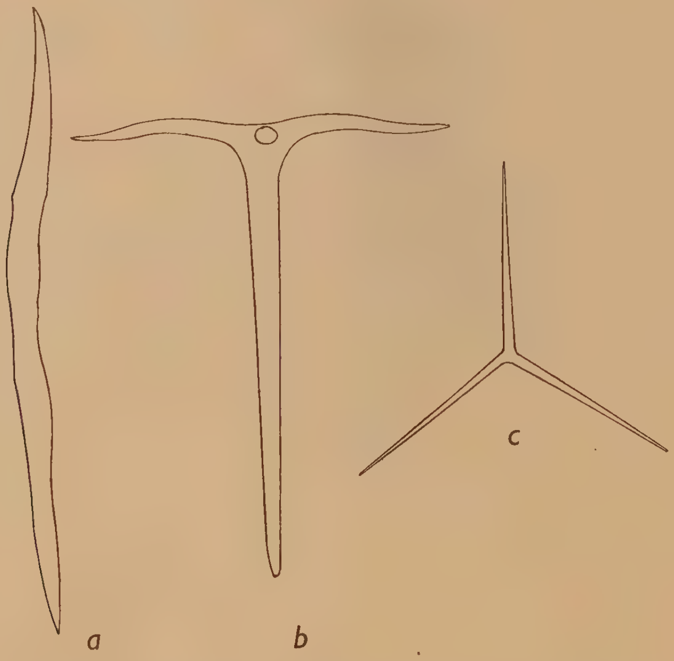

Fig. 5. *Leucaltis gastrorhabdifera*, sp.n. *a*, rhabd; *b*, sagittal quadriradiate; *c*, dermal triradiate. × 150.

The present species differs from the only other known species of the genus, *L. clathria*, Haeckel, in external form, in the absence of small radiates from the gastral and chamber layers, and in the presence of the large rhabds.

Genus Leucettusa, Haeckel

Leucettusa haeckeliana (Poléjaeff).

Leucetta haeckeliana, Poléjaeff, 1883, p. 69, pl. ii, fig. 6, pl. viii, figs. 1–6; *Leucettusa haeckeliana*, Dendy and Row, 1913, p. 739.

Occurrence. St. WS 84: Falkland Islands, 75–74 m.; St. WS 243: Falkland Islands, 144–141 m.

DISTRIBUTION. Kerguelen.

Leucettusa simplicissima, sp.n. (Plate XLVIII, fig. 3).

Holotype. B.M. 28. 2. 15. 35.

Occurrence. St. WS 84: Falkland Islands, 75–74 m.

DIAGNOSIS. Sponge tubular; skeleton of chamber layer composed of triradiates and quadriradiates of fairly constant size; cortical skeleton composed of a dense mass of large triradiates; without special gastral skeleton.

REMARKS. The species is represented by a quantity of branching tubes, each one being cylindrical and slightly flattened, with a single apical oscule. The tubes appear to have grown erect but now there is nothing to show their method of attachment. The largest are 3 cm. high and 7 mm. in diameter. There is no oscular fringe. The cortical and medullary layers are well marked, the latter being the thicker. The flagellated chambers are elongate, reaching from the gastral surface to just beneath the dermal cortex.

The chamber layer contains small triradiates and quadriradiates of fairly constant size scattered sparsely between the chambers. These are of the normal type and the rays of a typical example measure 0·036 by 0·006 mm. Occasionally these spicules may suffer reduction to two rays.

The cortical skeleton consists of a mass of large irregularly placed triradiates of fairly constant size, several layers thick, the rays of which may reach as much as 0·21 mm. in length and 0·018 mm. in thickness.

There is no special gastral skeleton, although occasionally triradiates similar in all respects to those of the chamber layer may be found lying tangentially in the wall of the gastral cavity.

The characteristic feature of this species is the simplicity of its skeleton, and in this it differs markedly from all the known species of *Leucettusa*. If anything is to be said of its relations to other species it is that *L. simplicissima* is more nearly like *L. tubulosa*, Dendy, from New Zealand, in external form, but approaches *L. haeckeliana* (Poléjaeff), from Kerguelen in spiculation. In fact, it differs from the latter mainly in the absence of the large quadriradiates.

Family GRANTIIDAE

Genus **Grantia**, Fleming

Grantia cirrata (Jenkin), var. **aurorae**, Dendy.

G. cirrata, var. *aurorae*, Dendy, 1918, p. 11, pl. I, figs, 4, 9.

Occurrence. St. 53: Falkland Islands, 0–2 m.; St. WS 33: South Georgia, 130 m.

DISTRIBUTION. Off Oates Land.

Grantia cirrata (Jenkin), var. **tenuipilosa**, n.

Type of var. B.M. 28. 2. 15. 708.

Occurrence. St. 53: Falkland Islands, 0–2 m.; St. WS 85: Falkland Islands, 79 m.

REMARKS. The two specimens are very like the typical form in external appearance, in the arrangement of the skeleton and in the size of the spicules. The only feature by which this variety may be distinguished is the form of the long oxea echinating the surface. These are usually 1·2 mm. in length but rarely exceed 0·012 mm. in diameter, and are only slightly, though very irregularly, curved.

The typical form of the species, together with the var. *aurorae* and the present variety, are all very much alike except for the form of the dermal oxea, and it is probable that a distinction into varieties is unnecessary. But until we can see for certain that the dermal oxea are subject to considerable variations in size, I prefer to consider the present specimens as constituting a separate variety of the species.

Order TETRAXONIDA

Sub-order *HOMOSCLEROPHORA*

Family PLAKINIDAE

Genus **Plakina**, Schulze

Plakina monolopha, Schulze.

P. monolopha, Schulze, 1880, p. 407, pl. xx, figs. 1–7, pl. xxii, figs. 22–29; Graeffe, 1882, p. 319; Sollas, 1888, p. 278; Topsent, 1890, p. 231; Lendenfeld, 1894, p. 96, pl. iii, fig. 46; Topsent, 1896, p. 549, pl. xxi, figs. 1, 2, pl. xxii, fig. 12; Thiele, 1898, p. 28, pl. v, fig. 13, pl. vii, fig. 11; Lendenfeld, 1903, p. 120; *id.*, 1907, p. 336; Topsent, 1925, p. 629; Burton, 1929, p. 414.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

DISTRIBUTION. North Atlantic; Mediterranean; Japan; Antarctic.

Plakina trilopha, Schulze.

P. trilopha, Schulze, 1880, p. 407, pl. xx, figs. 1–7; *Placina trilopha*, Sollas, 1888, p. 279; Topsent, 1890, p. 232; Lendenfeld, 1894, p. 98, pl. iii, fig. 45, pl. iv, fig. 54; Topsent, 1896, p. 555, pl. xxi, figs. 4–6; Lendenfeld, 1903, p. 121; *Plakina trilopha*, subsp. *antarctica*, *id.*, 1907, p. 333, pl. xxv, figs. 30–43; *Placina trilopha*, Babic, 1921, p. 17; *id.*, 1922, p. 291; *Plakina trilopha*, Burton, 1929, p. 414.

Occurrence. St. 140: South Georgia, 122–136 m.; St. 152: South Georgia, 245 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 80: Falkland Islands, 152–156 m.

DISTRIBUTION. Mediterranean; Wilhelm Land.

Sub-order *STREPTASTROSCLEROPHORA*

Family PACHASTRELLIDAE

Genus **Pachastrella**, Schmidt

Pachastrella monilifera, Schmidt.

(For synonymy see Burton, 1926, p. 9.)

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

DISTRIBUTION. Algeria; Mediterranean; Coast of Asturias; Cape Bojeador; Tristan da Cunha; Natal; Agulhas Bank.

Genus **Poecillastra**, Sollas

Poecillastra compressa (Bowerbank).

(For synonymy see Burton, 1930, pp. 487, 498.)

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

REMARKS. In two of the specimens the calthrops have undergone a considerable reduction and distortion, one or more of the rays being frequently reduced and those remaining being variously knobbed at the ends or ornamented with tubercles and spines. The condition closely resembles that of *Stelletta pathologica*, Schmidt, or *Pachastrella abyssi* (cf. Sollas, 1888, pl. xi, figs. 15–19). The distortion has extended to the microxea also, although not to the same extent, and these are thicker, less markedly roughened, but more strongly tylote than usual.

DISTRIBUTION. Arctic; North Atlantic (east and west coasts); Mediterranean.

Sub-order *ASTROSCLEROPHORA*

Family GEODIIDAE

Genus **Geodia**, Lamarck

Geodia magellani (Sollas).

Cydonium magellani, Sollas, 1886, p. 197; *id.*, 1888, p. 221, pl. xxi, figs. 1–14; *Geodia magellani*, Lendenfeld, 1903, p. 107; Thiele, 1905, p. 408.

Occurrence. St. WS 81: Falkland Islands, 81–82 m.

DISTRIBUTION. Tom Bay, Calbuco and Admiralty Straits (South America).

Family ERYLIDAE

Genus **Erylus**, Gray

Erylus discophorus (Schmidt).

(For synonymy see Lendenfeld, 1903, p. 87.)

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

REMARKS. The present specimen forms a thin brown crust on the surface of a piece of rock. The skeleton is composed as follows: amphistrongyles, 0·75 by 0·012 mm.; dichotriaenes, shaft 0·4 mm. long, primary cladi, 0·15 mm. long, and secondary cladi, 0·18 mm. long; sterrasters, 0·15 by 0·09 by 0·012 mm.; oxyasters, with 5–12 rays, 0·024–0·06 mm. in diameter, the larger spicules having usually the smaller number of rays; centrotylote microxea, 0·045 by 0·002 mm. In spiculation therefore the specimen agrees closely with the Mediterranean examples of the species except for the presence of strongyles instead of oxea. On the other hand, I am strongly inclined to the view that the spicules of the various species of *Erylus* may vary a great deal more than has hitherto been suspected, judging by my observations on a number of specimens of this genus from the Indo-Pacific.

The following species from the Atlantic, and adjacent waters, *E. discophorus*, *E. mammillaris*, *E. transiens*, *E. nummulifer*, *E. granularis* and *E. chavesi*, and *E. oxyaster* from the Galapagos Islands, all agree in possessing oxea, or their derivatives, dichotriaenes, sterrasters, oxyasters and microxea. The differences between them amount to no more than small, and probably unimportant, differences in external form and spiculation, and it is highly probable that they all represent nothing more than a single species.

DISTRIBUTION. Mediterranean; Spain.

Sub-order *SIGMATOSCLEROPHORA*

Family TETILLIDAE

Genus **Tetilla**, Schmidt

Tetilla leptoderma (Sollas).

(For synonymy see Burton, 1929, p. 418.)

Occurrence. St. 39: South Georgia, 179–235 m.; St. 140: South Georgia, 122–136 m.; St. 148: South Georgia, 132–148 m.; St. 170: Clarence Island, 342 m.; St. WS 27: South Georgia, 106–109 m.; St. WS 218: north of Falkland Islands, 311–247 m.; St. WS 225: Falkland Islands, 162–161 m.; St. WS 243: north-east of Falkland Islands, 144–141 m.

DISTRIBUTION. Kerguelen; South America; Victoria Land.

Genus **Cinachyra**, Sollas

Cinachyra antarctica (Carter).

(For synonymy see Burton, 1929, p. 419.)

Occurrence. St. 42: South Georgia, 120–204 m.; St. 175: South Shetlands, 200 m.

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land.

Cinachyra barbata, Sollas.

(For synonymy see Burton, 1929, p. 419.)

Occurrence. St. 27: South Georgia, 110 m.; St. 42: South Georgia, 120–204 m.; St. 123: South Georgia, 230–250 m.; St. 140: South Georgia, 122–136 m.; St. 153: South Georgia, 106 m.; St. 170: Clarence Island, 342 m.; St. 175: South Shetlands, 200 m.; St. WS 33: South Georgia, 130 m.; St. WS 42: South Georgia, 198 m.; St. MS 71: South Georgia, 120–60 m.

DISTRIBUTION. Kerguelen; Graham Land; Victoria Land; Wilhelm Land.

Cinachyra coactifera (Lendenfeld).

Tethya coactifera, Lendenfeld, 1906, p. 75, pl. ix, figs. 1–16, pl. x, figs. 1–10; *Cinachyra coactifera*, Burton, 1929, p. 396.

Occurrence. St. 39: South Georgia, 179–235 m.

REMARKS. The eleven specimens range from 6 to 12 cm. in diameter. The majority are without conspicuous surface pile or basal tuft, but in two of them both these features are well developed. The porocalices in the dried sponge are inconspicuous and might be easily mistaken for small and simple oscules, and it is probably on this account that the species was first referred to *Tethya* (= *Tetilla*).

DISTRIBUTION. Kerguelen.

Family HAPLOSCLERIDAE

Genus **Haliclona**, Grant

Haliclona nodosa (Thiele).

Reniera nodosa, Thiele, 1905, p. 461, figs. 7, 77.

Occurrence. St. 145: South Georgia, 26–35 m.

DISTRIBUTION. Calbuco, Chile.

Haliclona chilensis (Thiele).

Reniera chilensis, Thiele, 1905, p. 467, figs. 5, 84.

Occurrence. St. WS 84: Falkland Islands, 75–74 m.

REMARKS. A small tubular specimen agreeing with the holotype in all respects, except that it is dark brown in colour and possesses spicules measuring 0·12 by 0·009 mm. as against 0·165 by 0·01 mm. in the type.

DISTRIBUTION. Calbuco, Chile.

Haliclona variabilis (Thiele).

Acervochalina variabilis, Thiele, 1905, p. 477, figs. 17, 33, 96.

Occurrence. St. 53: Falkland Islands, 0–2 m.

REMARKS. Two of the specimens are almost identical in every way with the holotype (Thiele, *loc. cit.* pl. xxviii, fig. 17). The four other specimens, which resemble the holotype in skeleton, colour, texture and appearance of the surface, are irregularly pyriform with large oscules (Plate LI, figs. 1, 2).

DISTRIBUTION. Punta Arenas and Juan Fernandez.

Haliclona penicillata (Topsent).

Reniera penicillata, Topsent, 1908, p. 20, pl. ii, figs. 2, 3, pl. v, fig. 14; *Chalina penicillata*, Burton, 1929, p. 420.

Occurrence. St. 181: Palmer Archipelago, 160–335 m.; St. WS 108: Falkland Islands, 118–120 m.

REMARKS. The two specimens agree closely with the holotype except that in one of them the oxea are mostly centrotylote and a few are modified to styli.

DISTRIBUTION. Graham Land; Victoria Land.

Haliclona gaussiana (Hentschel).

Siphonochalina gaussiana, Hentschel, 1914, p. 136, pl. iv, fig. 17, pl. viii, fig. 17.

Occurrence. St. 42: South Georgia, 120–204 m.

REMARKS. The present specimen differs from the holotype only in the absence of polyspicular fibres and in the dimensions of the spicules. These are: oxea 0·15 mm. long, and toxa not exceeding 0·04 mm. in length.

The skeleton is a unispicular (renieroid) network with triangular mesh, and the outermost spicules hispidate the surface. There is no special dermal skeleton. The species is therefore a typical *Haliclona*.

DISTRIBUTION. Wilhelm Land.

Haliclona tubuloramosa (Dendy).

Gellius tubuloramosus, Dendy, 1924, p. 323.

Occurrence. St WS 243: Falkland Islands, 144–141 m.

REMARKS. A solitary example of this species is present. I have made a specially careful comparison with the holotype, since species common to the Falklands and to New Zealand are of rare occurrence.

DISTRIBUTION. New Zealand.

Haliclona conica (Brøndsted).

Pachychalina conica, Brøndsted, 1924, p. 454, fig. 12.

Occurrence. St. WS 243: Falkland Islands, 144–141 m.

REMARKS. Through the kindness of Dr Brøndsted I have been able to compare this specimen with the holotype and find an exact agreement in every way.

DISTRIBUTION. New Zealand.

Haliclona bilamellata, sp.n. (Plate XLVIII, figs. 5–9; Plate XLIX, figs. 1–3; Plate L, fig. 2; Fig. 6).

Holotype. B.M. 28. 2. 15. 121.

Occurrence. St. WS 27: South Georgia, 106–109 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 86: Falkland Islands, 151–147 m.; St. WS 87: Falkland Islands, 96–127 m.; St. WS 99: Falkland Islands, 251–225 m.; St. WS 243: Falkland Islands, 144–141 m.; St. WS 247: Falkland Islands, 172 m.

DIAGNOSIS. Sponge tubular, infundibular or bilamellate; texture elastic, very soft, somewhat friable; outer surface minutely hispid, shaggy, often thrown into irregular folds; inner surface even, minutely hispid, bearing numerous exhalant apertures varying up to 3 mm. in diameter; colour, in spirit, greenish yellow or brown; skeleton a regular isodictyal reticulation with bi- to trispicular primary fibres connected by transverse single spicules at regular intervals; oxea measuring 0·16 by 0·007 mm.

REMARKS. The holotype (Plate XLVIII, figs. 5, 6) is an incomplete sponge, apparently infundibular in life, bearing a strong resemblance to *Calyx* (*Gellius*) *imperialis* (Dendy)[1] from New Zealand, with which at first sight it might be easily confused. All the remaining specimens are damaged, though some only to a slight extent, and they vary from tubular to bilamellate.

The characteristic feature of the species is the external form. In many respects this is like that of *H.* (*Reniera*) *Scotti* (Kirkpatrick), but the sizes of the respective spicules differ too much to allow of a specific identity at the moment.

There are a number of other specimens which, in spite of the differences in external form, appear to belong to the same species. All have the same soft, friable texture, the same appearance and a very similar type of skeleton. The diversity in external form exhibited by them furnishes a good example of the extent to which the Chalinine sponges may vary.

The external form of these specimens is as follows:

Specimen 1. More or less pyriform with a deep cloaca, the walls of which are marked with large exhalant apertures. Surface minutely conulose. Colour dark brown (Fig. 6 *a*).

Specimen 2. Stipitate and tubular, with deep cloaca, the walls of which are marked with large exhalant apertures. Surface markedly conulose, particularly near the top of the sponge. Colour dark brown (Fig. 6 *b*).

Specimen 3. Sponge tubular in the lower two-thirds, infundibuliform above. Surface of lower two-thirds with long, slender spinose processes. Colour dark brown (Fig. 6 *c*).

Specimen 4. Sponge tubular. Surface covered with spinose processes (Plate XLIX, fig. 1).

Specimen 5. Sponge tubular. Surface covered with low, rounded, irregular ridges (rather like *Haliclona dancoi* (Topsent) in appearance). Colour yellow (Plate XLVIII, fig. 9).

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[1] *Gellius imperialis*, Dendy, is a typical *Calyx*, differing from *C. arcuarius* (Topsent), described on page 277, in its external form and in the substitution of sigmata for toxa. In all other respects the two species are practically identical.

Specimen 6. Infundibular, 15 cm. high, 9 cm. across. Outer surface thrown into strongly developed rounded ridges. Colour dark brown (Plate XLVIII, figs. 5–8).

Specimen 7. Flabelliform, one surface pore-bearing with spinose processes: the other bearing oscules. Colour yellow (Plate XLIX, figs. 2–3).

With the exception of specimen 7, all have a deep cloaca with oscules measuring up to 4 mm. in diameter. The series also shows that the species has a range of form very like that of *Haliclona dancoi* (*sensu* Burton, 1929, p. 420), and differs from that species only in texture and the size of the spicules.

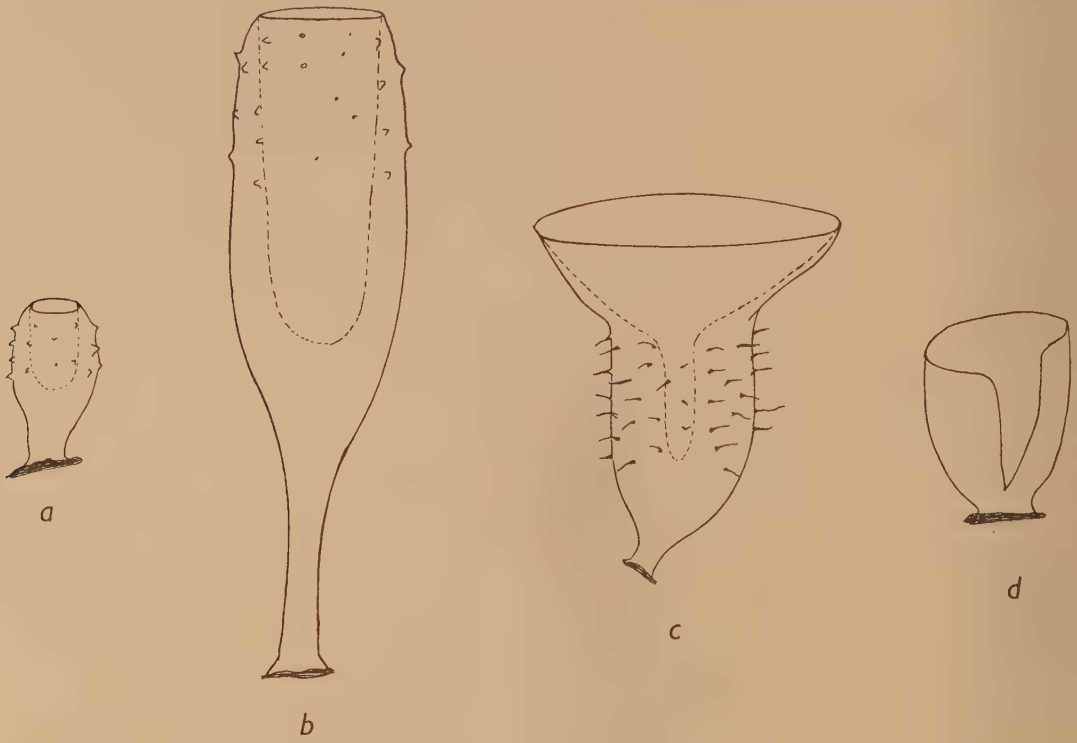

Fig. 6. Series showing external form in the smaller specimens of *Haliclona bilamellata*, sp.n. Dotted lines indicate shape and position of cloaca.

While the external form is similar in every case, two types of skeleton are found. In some specimens it is chalinoid and consists of a quadrangular network in which the primary fibres contain a double row of spicules coated with a thin layer of spongin and the secondary fibres contain one spicule only, the primary fibres being only one spicule length apart. The oxea in these forms vary from 0·132 to 0·18 by 0·007 to 0·008 mm. In the remaining specimens, the skeleton is pachychalinoid and consists of a quadrangular network of stout primary fibres, containing from eight to ten spicules serially arranged, but with very little spongin, and secondary fibres containing three or four spicules. The meshes of the network are from 0·3 to 0·4 mm. across and the spicules 0·240 by 0·01 mm. This separation into two types is, however, more apparent than real, for in the second group the skeleton may, in places, be identical with that of the first group, so that we have here definite evidence of the transition from a chalinoid to a pachychalinoid skeleton in one and the same species.

The species is very like *Haliclona flaccida* (Topsent), but this has spicules measuring 0·56 to 0·57 by 0·017 mm. As recorded above, however, there is considerable variation in the size of the spicules of *H. bilamellata*, and it is conceivable that the new species and *H. flaccida* may even yet prove to be identical; and possibly also synonymous with *H. dancoi*.

There are also four specimens, from Sts. WS 27, WS 86 and WS 99, which have oxea measuring 0·35 by 0·009 mm. and a skeleton, composed of primary lines 8–12 spicules thick and secondary lines 2–4 spicules thick, which gives a more fibrous appearance to the sponge (cf. Plate XLIX, figs. 2, 3). In external form, however, they show the same transitions from tubular to infundibular. One specimen in particular is worth attention, from St. WS 86. This is sub-infundibular, rather like a cup with a cut extending from rim to base (Fig. 6 *d*).

Haliclona stephensi, sp.n.

Holotype. B.M. 28. 2. 15. 102.

Occurrence. Saldanha Bay (beach).

Diagnosis. Sponge thinly encrusting (always?); surface smooth, even, minutely hispid; texture friable; colour, in spirit, yellow; skeleton an irregular network of single spicules, perhaps quadratic in places, with ill-defined polyspicular bundles usually running towards surface of sponge; oxea slightly curved, abruptly pointed, 0·12 by 0·006 mm.

Remarks. The single specimen, an incrustation several square centimetres in area, on a pebble, appears to agree closely with *Reniera* sp. from Reit's Bay described by Stephens (1915, p. 464).

Haliclona petrosioides, sp.n. (Fig. 7).

Holotype. B.M. 28. 2. 15. 434.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

Diagnosis. Sponge encrusting to massive and spreading; surface uneven, minutely hispid; texture friable; oscules and pores not apparent; colour, in spirit, white; skeleton a regular isodictyal network with primary and secondary lines five spicules thick, and with numerous isolated spicules scattered between meshes of main skeleton; spongin not apparent; oxea slightly curved, 0·154 by 0·007 mm.

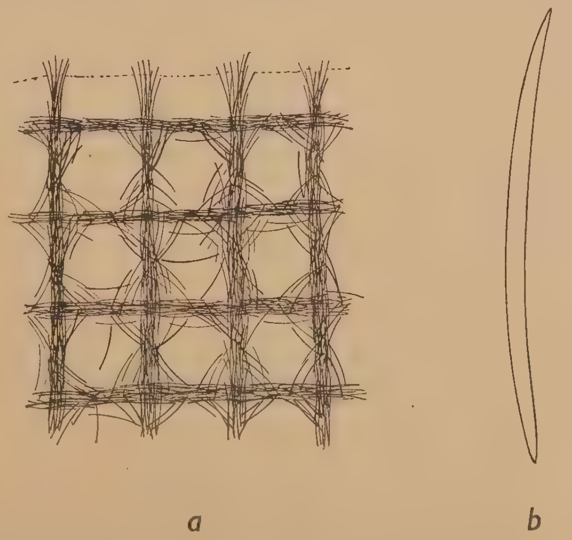

Fig. 7. *Haliclona petrosioides*, sp.n. *a*, section at righ angles to surface, showing structure of main skeleton × 60; *b*, an oxeote, × 400.

REMARKS. The species appears to differ from all other species of *Haliclona* in the regularity and compactness of the skeleton, combined with the small size of the spicules. It appears to be most closely related to several of the varieties of *Petrosia similis*, Ridley and Dendy, from the Indian Ocean and the Kerguelen area.

Genus **Haliclonissa**, gen.n.

Genotype. H. verrucosa, sp.n.

DIAGNOSIS. Haplosceridae with skeleton composed of fibres running vertically to surface, often anastomosing to form an irregular network, with numerous isolated spicules scattered between; without special dermal skeleton.

REMARKS. The genus appears to be intermediate between *Haliclona* and *Microxina*.

Haliclonissa verrucosa, sp.n. (Plate LI, fig. 3; Fig. 8).

Holotype. B.M. 28. 2. 15. 473.

Occurrence. St. 180: Palmer Archipelago, 160 m.

DIAGNOSIS. Sponge composed of stout, irregularly cylindrical branches, bearing a few conspicuous oscules 10 mm. in diameter; oscules leading out from shallow, capacious cloacae; surface verrucose; texture friable; colour, in spirit, pale yellow; skeleton composed of diffuse fibres, 6–20 spicules thick, running vertically to surface and forming in places an irregular network, with numerous isolated spicules scattered between; spongin inconspicuous; oxea slightly curved, tapering gradually to a point at each end, 0·5 by 0·017 mm.

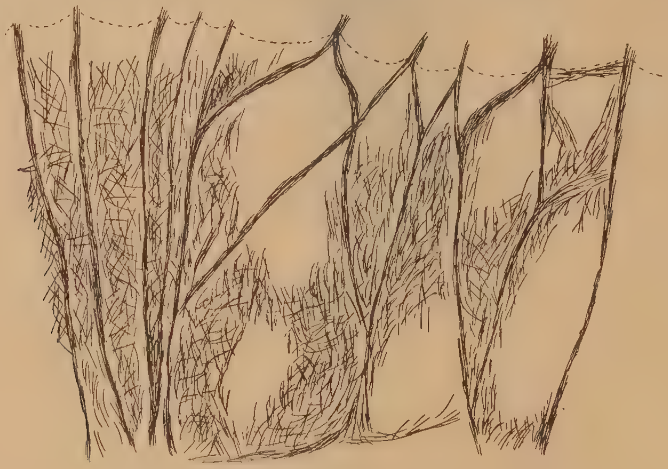

Fig. 8. *Haliclonissa verrucosa*, sp.n. Section at right angles to surface, to show structure of skeleton. × 10.

REMARKS. The holotype measures 13 cm. long by approximately 5 cm. in diameter. In places it is almost regularly cylindrical, but is mainly somewhat flattened laterally. It resembles in appearance some of the Antarctic species of *Isodictya* and also, to a lesser extent, *Hemigellius rudis* (Topsent), but the structure of the skeleton shows that it belongs to a different genus.

Haliclonissa sacciformis, sp.n. (Plate XLVIII, fig. 10; Fig. 9).

Holotype. B.M. 28. 2. 15. 621.

Occurrence. St. WS 223: Falkland Islands, 114 m.

DIAGNOSIS. Sponge sacciform, sessile, erect; surface soft to touch, minutely pilose, having an appearance of fine velvet; exhalant apertures opening into a deep central cloaca; texture very soft and compressible; colour, in spirit, yellowish grey; skeleton of stout multispicular primary fibres running vertically to surface, connected by diffuse and irregular secondary fibres, with numerous isolated spicules scattered between; spicules slender oxea measuring 0·32 by 0·007 mm.

REMARKS. The single specimen is laterally compressed, about 13 cm. high, 9 cm. across and 2·5 cm. wide, with a wide mouth at the apex leading into a deep and capacious cloaca. It resembles *Chalina spongiosissima*, Topsent closely in texture, but differs in the external form and the size of the spicules. The primary lines of the skeleton, too, are multispicular instead of bi- or trispicular.

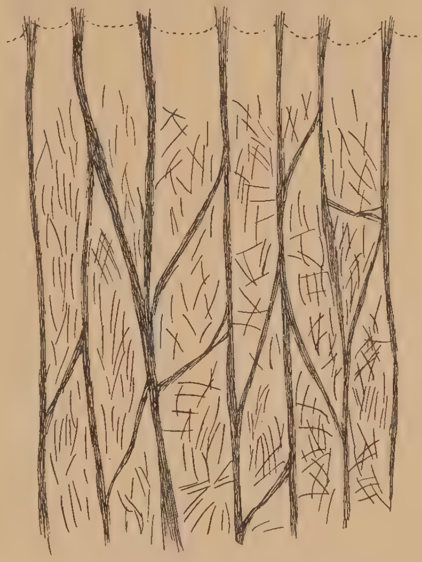

Fig. 9. *Haliclonissa sacciformis*, sp.n. Section at right angles to surface. × 20.

Genus Microxina, Topsent

Microxina benedeni (Topsent) (Plate L, fig. 1; Fig. 10).

Gellius benedeni, Topsent, 1901, p. 6; *Gelliodes benedeni*, *id.*, *loc. cit.*, p. 16, pl. ii, fig. 3, pl. iii, fig. 5; *Microxina charcoti*, Topsent, 1916, p. 170; *id.*, 1917, p. 72, pl. i, fig. 3, pl. ii, fig. 3, pl. vi, fig. 17; *Gelliodes benedeni*, var. *fortior*, *id.*, 1917, p. 75, pl. ii, fig. 1, pl. vi, fig. 22; *G. benedeni*, Burton, 1929, p. 423; *Microxina charcoti*, *id.*, *loc. cit.*, p. 423.

Occurrence. St. 39: South Georgia, 179–235 m.; St. 149: South Georgia, 200–234 m.; St. 190: Palmer Archipelago, 315 m.; St. WS 81: Falkland Islands, 81–82 m.; St. WS 99: Falkland Islands, 251–225 m.; St. WS 248: Falkland Islands, 210–242 m.

REMARKS. The British Museum now possesses a considerable number of specimens of *Gelliodes benedeni* and *Microxina charcoti*, and from these it is clear that the two species are alike in external form and spiculation, except that the first possesses sigmata only, with the addition of raphides in the var. *fortior*, and the second has microxea only. This being the

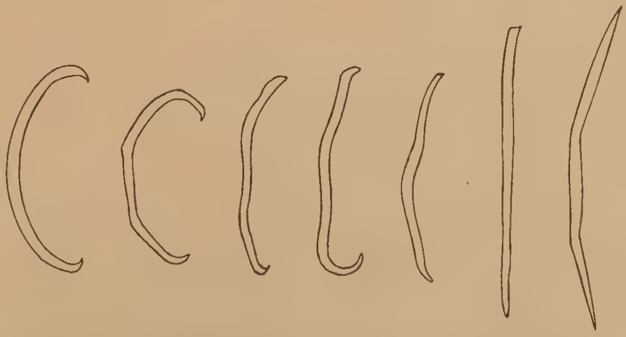

Fig. 10. *Microxina benedeni* (Topsent), showing transition from sigmata to microxea.

case, the suspicion that the two species are identical is unavoidable. The present specimens offer abundant evidence that this is in fact the case.

The Discovery collection contains eight specimens; five of these had been provisionally identified by me as *Microxina charcoti* and three as *Gelliodes benedeni*. On re-examination, I found that several of the former contained isolated long, slender raphides, and this was also the case in each specimen of the second species, but they were never grouped in dragmata as in *Gelliodes benedeni*, var. *fortior*. Secondly, one specimen of *G. benedeni* contained sigmata only, a second contained sigmata and an occasional microxeote, and the third contained all transitions from sigmata to microxea (Fig. 10). In addition, it is worth noting that the sigmata in *Gelliodes benedeni* are frequently centrotylote, like the microxea of *Microxina charcoti*. It is evident therefore that we have to deal here with a single species, the microscleres of which may be sigmata and/or microxea, to which raphides, either isolated or in dragmata, may be added.

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land.

Genus **Hemigellius**, gen.n.

Genotype. Gellius rudis, Topsent.

DIAGNOSIS. Haplosceridae with skeleton composed of a coarse and irregular reticulation of oxea formed by multispicular primary fibres, running vertically to surface, and uni- or multispicular connecting fibres; special dermal skeleton formed by ends of primary fibres spreading out beneath ectosome in a paniculate manner; microscleres, when present, sigmata.

REMARKS. The original description gives little information regarding the structure of the skeleton in *Gellius rudis* (see Topsent, 1901, p. 14); but the surface is said to be finely hispid, which at least indicates the absence of a tangential dermal skeleton. Kirkpatrick's (1908) specimens assigned to this species resemble the holotype sufficiently, however, to justify the framing of a diagnosis, as has been done here, on the characters observed in his specimen.

The genus is closely allied to *Haliclona*.

Hemigellius rudis (Topsent).

Gellius rudis, Topsent, 1901, p. 6; *id.*, 1901, p. 14, pl. i, fig. 9, pl. iii, fig. 4; *id.*, 1907, p. 77, pl. iii, fig. 2; *G. fimbriatus*, Kirkpatrick, 1907, p. 86; *G. rudis*, *id.*, 1908, p. 45, pl. xvii, fig. 1; *G. fimbriatus*, *id.*, *loc. cit.*, p. 46, pl. xvii, fig. 2, pl. xxiv, fig. 2; *G. rudis*, Hentschel, 1914, p. 287; Burton, 1929, p. 422.

Occurrence. St. 39: South Georgia, 179–235 m.; St. 42: South Georgia, 120–204 m.; St. 170: Clarence Island, 342 m.

REMARKS. In a former work (*loc. cit.*) I included *Gellius pilosus*, Kirkpatrick, and *G. tenellus*, Topsent, as synonyms of this species. As shown on p. 276 the latter is now included in the genus *Adocia*. As regards *G. pilosus*, Kirkpatrick, there can be little doubt that it is congeneric with *Hemigellius rudis* (Topsent), but whether it is conspecific is not so certain, and it is perhaps preferable to recognize it as a distinct species.

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land.

Hemigellius pachyderma, sp.n. (Plate XLVIII, fig. 4; Fig. 11).

Holotype. B.M. 28. 2. 15. 723.

Occurrence. St. WS 210: Falkland Islands, 161 m.

DIAGNOSIS. Sponge consisting of massive cylindrical branches; surface even, minutely hispid; texture friable; oscules conspicuous, 3–4 mm. in diameter, scattered irregularly over surface; pores apparently evenly distributed; subdermal cavities large; colour, in spirit, greyish yellow; skeleton a reticulation consisting of stout spicule bundles, 5–7 spicules thick, running towards surface and anastomosing slightly, connected by isolated spicules set at varying angles; main vertical fibres ending immediately beneath surface in a dense subdermal palisade; oxea slightly curved, measuring 0·28 by 0·014 mm.

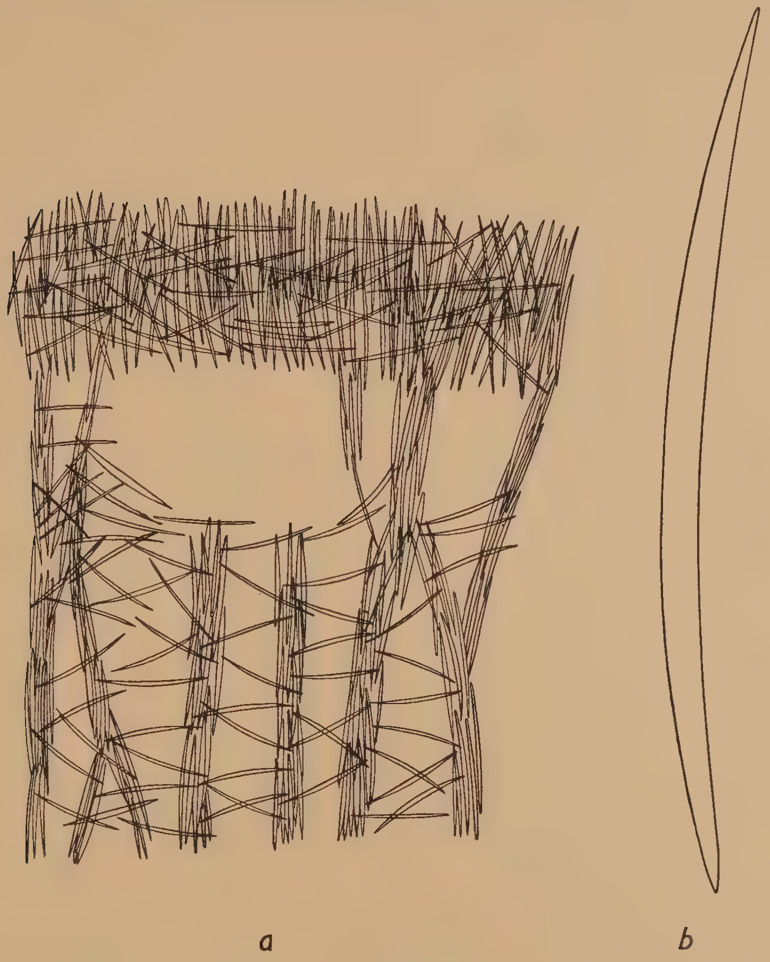

Fig. 11. *Hemigellius pachyderma*, sp.n. *a*, section at right angles to surface, showing structure of main skeleton, × 30; *b*, oxeote, × 400.

Remarks. The holotype consists of two fragments, the one a small portion of a cylindrical branch, and the other a cylindrical branch, 2 cm. in diameter, which bifurcates at one end into two short branches rounded at the ends. The second specimen is in fact almost identical in appearance with the specimen figured by Kirkpatrick (1908, pl. xvii, fig. 1) under *Gellius rudis*, Topsent.

Hemigellius pachyderma, sp.n., differs from *H. rudis* (Topsent) mainly in the size of the spicules, in the absence of sigmata, and in the dense aggregation of spicules immediately beneath the dermis. But all these characters are comparative, and it may possibly be shown eventually that the two species are synonymous. In any case, the dermal palisade may certainly be accepted as the homologue of the paniculate surface brushes in *H. rudis*.

Genus **Adocia**, Gray

Adocia carduus (Ridley and Dendy).

Gellius carduus, Ridley and Dendy, 1886, p. 333; *G. laevis*, *id.*, *loc. cit.*, p. 333; *G. carduus*, *id.*, 1887, p. 39, pl. viii, fig. 3, pl. xiii, fig. 7; *G. carduus*, var. *magellanica*, *id.*, *loc. cit.*, p. 40, pl. xiii, fig. 6; *G. laevis*, *id.*, *loc. cit.*, p. 40, pl. xiii, fig. 8.

Occurrence. St. 160: near Shag Rocks, 177 m.; St. 177: South Shetlands, 1080 m.; St. WS 81: Falkland Islands, 81–82 m.; St. WS 83: Falkland Islands, 137–129 m.

Remarks. Judging from the observations made on the new material, there is no possibility of distinguishing between *Gellius carduus* and its variety *magellanica* and *G. laevis*. The external form of the new specimens resembles, in each case, that of *G. carduus*, var. *magellanica*. The megascleres, which vary from oxea to incipient strongyla, measure from 0·3 to 0·45 mm. long, and the sigmata vary from 0·015 to 0·02 mm. chord.

Distribution. Crozet Island; Prince Edward Island; Marion Island; Magellan Straits; mouth of the Rio de la Plata.

Adocia glacialis (Ridley and Dendy).

Gellius glacialis, Ridley and Dendy, 1886, p. 333; *id.*, 1887, p. 41, pl. viii, fig. *u*, pl. xiii, figs. 1, 15, 19; *G. glacialis*, var. *nivea*, *id.*, *loc. cit.*, p. 42, pl. viii, fig. 8, pl. xiii, figs. 4, 12; Kirkpatrick, 1908, p. 49, pl. xvii, fig. 4; Burton, 1929, p. 397.

Occurrence. St. 140: South Georgia, 122–136 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 82: Falkland Islands, 140–144 m.; St. WS 83: Falkland Islands, 137–129 m.

Remarks. Comparison of the present specimens with those in the Swedish Antarctic Collection and with the types of both the species and its variety has shown that the var. *nivea* cannot be maintained. The question will be dealt with fully in my forthcoming report on the sponges of the Swedish Antarctic Expedition.

The sigmata in one of the present specimens resemble those of *A.* (*Gellius*) *flagellata* (Ridley and Dendy).

Distribution. Agulhas Bank; Prince Edward Isle; Victoria Land.

A comparison between A. carduus *and* A. glacialis

On comparing the types of *Gellius carduus*, *G. carduus*, var. *magellanica*, *G. laevis*, *G. glacialis* and *G. glacialis*, var. *nivea*, I find that there is no real difference between them in external form or in the structure of the skeleton. The only distinction that can be made rests on the differences in the dimensions of the spicules, especially of the microscleres. I have already suggested that this group of three species and two varieties represents no more than two species, so that the differences between these two species may be expressed in the following way:

G. carduus: Oxea 0·49–0·6 mm. long; sigmata 0·02 mm. chord.

G. glacialis: Oxea 0·53–0·65 mm. long; sigmata up to 0·145 mm. chord.

It is evident from the examination of specimens which have come to hand since these species were first described that the sigmata in *G. glacialis* rarely measure so much as 0·145 mm. Sigmata are always present measuring 0·02 mm. and, in addition, larger sigmata measuring 0·06, 0·07, 0·08, up to 0·12 mm. or so. Further, the larger and smaller sigmata are not differentiated into two distinct categories, but are connected by numerous forms intermediate in size. I suspect therefore that the species called here *Adocia carduus* is merely a form of *A. glacialis* in which the larger sigmata have dropped out. It may be necessary to regard them ultimately as conspecific, but I would like to have more material for examination before taking this step.

There is, however, another point to be noted: that in the present collection there is nearly a score of specimens from Sts. 160 and 177 which have the same general appearance as *A. carduus* and *A. glacialis*, the same arrangement of the skeleton, and the same type of megascleres (i.e. oxea varying from abruptly pointed to sub-strongylote). All these specimens are clearly conspecific and obviously belong either to *A. carduus* or to *A. glacialis*, but to which it is quite impossible to say since none of them possesses a single microsclere. It seems to me therefore that in this group of specimens from Sts. 160 and 177, we have a number of individuals in which the reduction of the microscleres, believed to have taken place in *A. carduus*, has been taken a step further by the complete suppression of all microscleres.

Adocia siphonella (Thiele).

Reniera siphonella, Thiele, 1905, p. 460, figs. 75, 97–99.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

Remarks. The spicules in this specimen are usually strongyla, with a few oxea, measuring 0·32 by 0·018 mm. Only a few fragments are to hand, but from these it appears that, if my identification is correct, the species belongs to *Adocia*. Through the kindness of Dr Arndt, of the Berlin Museum, I have been able to compare the present specimen with one of the types, but as this also is in a fragmentary condition it does not help in determining the generic position of the species.

Distribution. Calbuco, Chile.

Adocia cucurbitiformis (Kirkpatrick).

Gellius cucurbitiformis, Kirkpatrick, 1907, p. 288; *id.*, 1908, p. 48, pl. xvii, fig. 5, pl. xxiv, fig. 5.

Occurrence. St. 180: Palmer Archipelago, 160–330 m.

DISTRIBUTION. Victoria Land.

Adocia tremulus (Topsent).

Gellius tremulus, Topsent, 1916, p. 171; *id.*, 1917, p. 79, pl. i, fig. 7, pl. vi, fig. 20.

Occurrence. St. 175: South Shetlands, 200 m.

REMARKS. The specimen is quite typical except that no raphides are present.

DISTRIBUTION. Graham Land.

Adocia tenellus (Topsent).

Gellius tenellus, Topsent, 1916, p. 171; *id.*, 1917, p. 80, pl. vi, fig. 23.

Occurrence. St. WS 88: Falkland Islands, 96–127 m.

REMARKS. There is a doubt about the locality in this case so that it would be inadvisable to say much concerning the bearing that this specimen may have on the value of the species or its distribution. The specimen itself is massive, with spicules of the same shape and dimensions as those of the holotype of *Gellius tenellus*, and the skeleton is a unispicular network throughout.

DISTRIBUTION. Petermann Islands.

"**Gellius fibulatus.**"

Occurrence. St. WS 82: Falkland Islands, 140–144 m.

REMARKS. The specimen recorded under this title is a small massive sponge, of a very friable texture, which reached me in a fragmentary and slightly macerated condition. It appears to belong to *Adocia*, but of this it is impossible to be sure. The skeleton is a unispicular, occasionally bispicular, network of oxea measuring 0·12 by 0·008 mm., slightly curved and gradually and evenly pointed towards each end. The sigmata are of the usual type and measure up to 0·05 mm. chord.

Reniera fibulatus, Schmidt (= *Gellius fibulatus*, Autt.), is a species of which we know nothing with certainty. The holotype has not been seen since Schmidt first described it, and the original description is hopelessly inadequate. All we know is that its skeleton was composed of oxea and sigmata, but the sizes of these respective spicules are unknown. Since Schmidt first established the species, it has been used by succeeding authors for almost any sponge possessing small oxea and sigmata, so that, in the conventional sense, the present sponge belongs to Schmidt's species.

The only reason for recording such a poorly preserved specimen is that it is from a locality from which we have very few records and there is just the hope that, when the so-called species "*Gellius fibulatus*" has been correctly split into its component parts, we may be able to determine this particular specimen with certainty.

Genus **Calyx**, Vosmaer

Calyx arcuarius (Topsent).

Gellius arcuarius, Topsent, 1913, p. 638, pl. vi, fig. 11; *Calyx stipitatus*, *id.*, 1916, p. 171; *id.*, 1917, p. 81, pl. iv, fig. 13, pl. vi, fig. 24; Burton, 1929, p. 422, pl. v, figs. 5, 6.

Occurrence. St. 39: South Georgia, 179–235 m.; St. 148: South Georgia, 132–148 m.; St. 149: South Georgia, 200–234 m.; St. 159: South Georgia, 160 m.; St. 160: Shag Rocks, 177 m.; St. 163: South Orkneys, 18–27 m.; St. 175: South Shetlands, 200 m.

REMARKS. There are several specimens which correspond closely with the original description of *Calyx stipitatus* and with the specimens recorded by me under that name in 1929. They are all thinly flabellate, the largest 40 cm. high and about the same across, with evenly rounded margins, often with rounded outgrowths springing from the main body. The surface is even, glabrous or only minutely hispid. The skeleton is composed of stout bundles of oxea, usually 20–40 deep, running from base to margin, branching and anastomosing, with a confused triangular network of single spicules filling the spaces between the bundles. The dermal skeleton is a tangential unispicular network, in which the spicules are often irregularly set so that the ends frequently project slightly at the surface. In this way, although there is a special dermal skeleton comparable with that found in *Adocia*, the surface is minutely hispid. The oxea vary from 0·18 to 0·28 mm. long by 0·011 to 0·018 mm. thick.

The external form varies from branching, as in the specimen figured by me (*loc. cit.*, pl. v, fig. 6), to flabellate, and the disposition of the oscules may be on one of two plans, a few conspicuous oscules (cf. Burton, *loc. cit.*, pl. v, figs. 5, 6) or numerous small oscules scattered over one surface only (cf. Topsent, 1917, pl. iv, fig. 13). I was wrong therefore in regarding the "orifices circulaires" (1929, p. 422) as due to commensal cirripedes.

Calyx arcuarius, Topsent, is a species of varied form, with a dimorphic system of exhalant apertures, and these different variations are well shown in the present series of specimens. On the other hand, the main skeleton is constant in structure and forms a character by which the species may be readily recognized. There can therefore be no doubt that all the specimens before me at the moment are conspecific. In view of this, the following observation is of particular interest; namely, that some of these specimens have abundant toxa, 0·07–0·1 mm. long, some only a few, and some appear to be entirely without them. It is obvious then that *Gellius arcuarius*, Topsent, and *Calyx stipitatus*, Topsent, are synonymous, the holotype of the former being a fragment of a large flabellate sponge having toxa in abundance, and the holotype of the latter being an incomplete specimen having no toxa. We have to accept, as a consequence, the following facts: that the members of the genus *Calyx*, a genus hitherto regarded as characterized by the absence of microscleres, may possess toxa; that the absence of a particular microsclere has, *per se*, no taxonomic value.

DISTRIBUTION. South Orkneys; Victoria Land.

Calyx kerguelensis (Hentschel).

Gelliodes kerguelensis, Hentschel, 1914, p. 127, pl. viii, fig. 11.

Occurrence. St. 58: Falkland Islands, on piles of Government Jetty; St. 140: South Georgia, 122–136 m.

REMARKS. This species, represented in the collection by a piece of a stout, cylindrical sponge, has a skeleton very similar to that of *C. arcuarius* except that the dermal skeleton is somewhat more diffuse.

In the present specimen, the sigmata measure, for the most part, up to 0·04 mm. chord, but a few measure up to 0·1 mm.

DISTRIBUTION. Kerguelen.

Genus **Dasychalina**, Ridley and Dendy.

Genotype. D. fragilis, Ridley and Dendy.

DIAGNOSIS. Haploscleridae with dermal skeleton composed of an irregular multispicular reticulation subdivided into primary and secondary meshes; main skeleton of stout multispicular fibres, or systems of anastomosing fibres, with numerous isolated spicules scattered between; spongin absent or present in very small quantities.

REMARKS. This genus, established by Ridley and Dendy (1886, p. 329), was abandoned by them (1887) because of a suspected identity with *Pachychalina*, Schmidt. The characters of the latter are, however, unknown to us, and because *Dasychalina fragilis* differs in the structure of its skeleton from other species of "*Pachychalina*" Autt., it is proposed here to revive the use of the name. *Dasychalina* is intermediate between *Adocia* and *Callyspongia* (= "*Pachychalina*", Autt.).

Dasychalina validissima (Thiele) (Plate L, figs. 3–7; Fig. 12).

Pachychalina validissima, Thiele, 1905, p. 473, figs. 16, 91; *Halichondria magellanica*, Dendy, 1924, p. 325.

Occurrence. St. 51: Falkland Islands, 115 m.; St. 53: Falkland Islands, 0–2 m.; St. 140: South Georgia, 122–136 m.; St. WS 73: Falkland Islands, 121 m.; St. WS 76: Falkland Islands, 205–207 m.; St. WS 77: Falkland Islands, 110–113 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 109: Falkland Islands, 145 m.; St. WS 233: Falkland Islands, 185–175 m.; St. WS 237: Falkland Islands, 150–256 m.; St. WS 243: Falkland Islands, 144–141 m.

REMARKS. The specimens may be massive, as in the holotype, massively branched, with branches cylindrical or flattened, or flabellate (Pl. L, figs. 3–7), while the surface may be smooth, tuberculate or spinose. The skeleton varies from that shown in Fig. 12 *a* to that in Fig. 12 *b*. In spite of the difference in appearance, these two types of skeleton structure are essentially the same. In the holotype (Fig. 12 *a*) the skeleton consists of a reticulation of stout multispicular fibres, with numerous isolated spicules scattered between, but in most of the present specimens (Fig. 12 *b*) the multispicular fibres are resolved into anastomosing systems of smaller fibres. There are, however, all gradations between these two extremes. The oxea measure 0·15–0·32 mm. long.

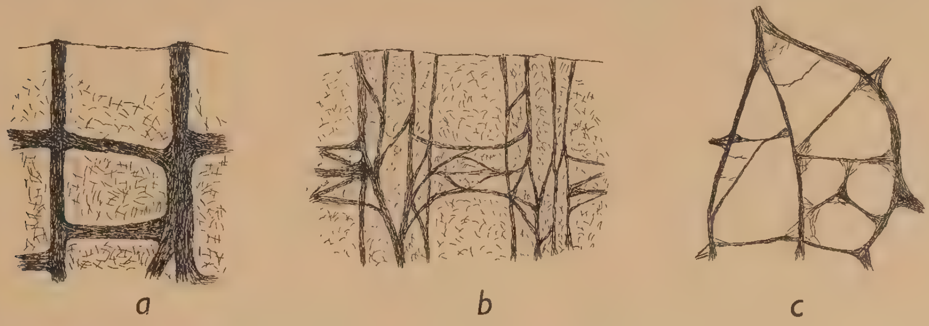

Fig. 12. *Dasychalina validissima* (Thiele). *a*, *b*, sections at right angles to surface (*a* is from holotype); *c*, dermal skeleton. All × 7½.

Distribution. Calbuco; Straits of Magellan.

Genus **Callyspongia**, Duchaissang and Michelotti.

Callyspongia fortis (Ridley) (Figs. 13, 14).

Siphonochalina fortis, Ridley, 1881, p. 111, pl. x, fig. 3.

Occurrence. St. WS 72: Falkland Islands, 95 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 86: Falkland Islands, 157–147 m.

Diagnosis. Sponge sub-ramose to lobose; surface minutely conulose; oscules large, conspicuous, situated on crater-like projections or with margins level with surface, in all cases leading into deep cloacae receiving large exhalant canals which penetrate body of sponge; pores apparently scattered in meshes of dermal skeleton; skeleton differentiated into main and dermal; main skeleton consisting of a coarse-meshed network of stout spongin fibres, often 0·3 mm. thick, containing an axial row of spicules, multispicular in primary fibres, unispicular in secondary fibres; meshes of main skeleton ranging from 0·4 to 1·2 mm. across; dermal skeleton a tangential network of fibres differentiated into primary, secondary and tertiary fibres; primary fibres stout, of similar dimensions to those of main skeleton; mesh usually triangular, but may be quadrate or polygonal and divided into secondary and tertiary meshes; dimensions of latter usually no more than a spicule length across; spicules oxea, straight, 0·066 by 0·006 mm.

Remarks. The species is characterized by its external form and by the small size of its spicules.

The inadequacy of *Ceraochalina*, as a genus for the reception for all Chalininae in which the spicules are vestigial, is shown by one specimen in which the fibres of the

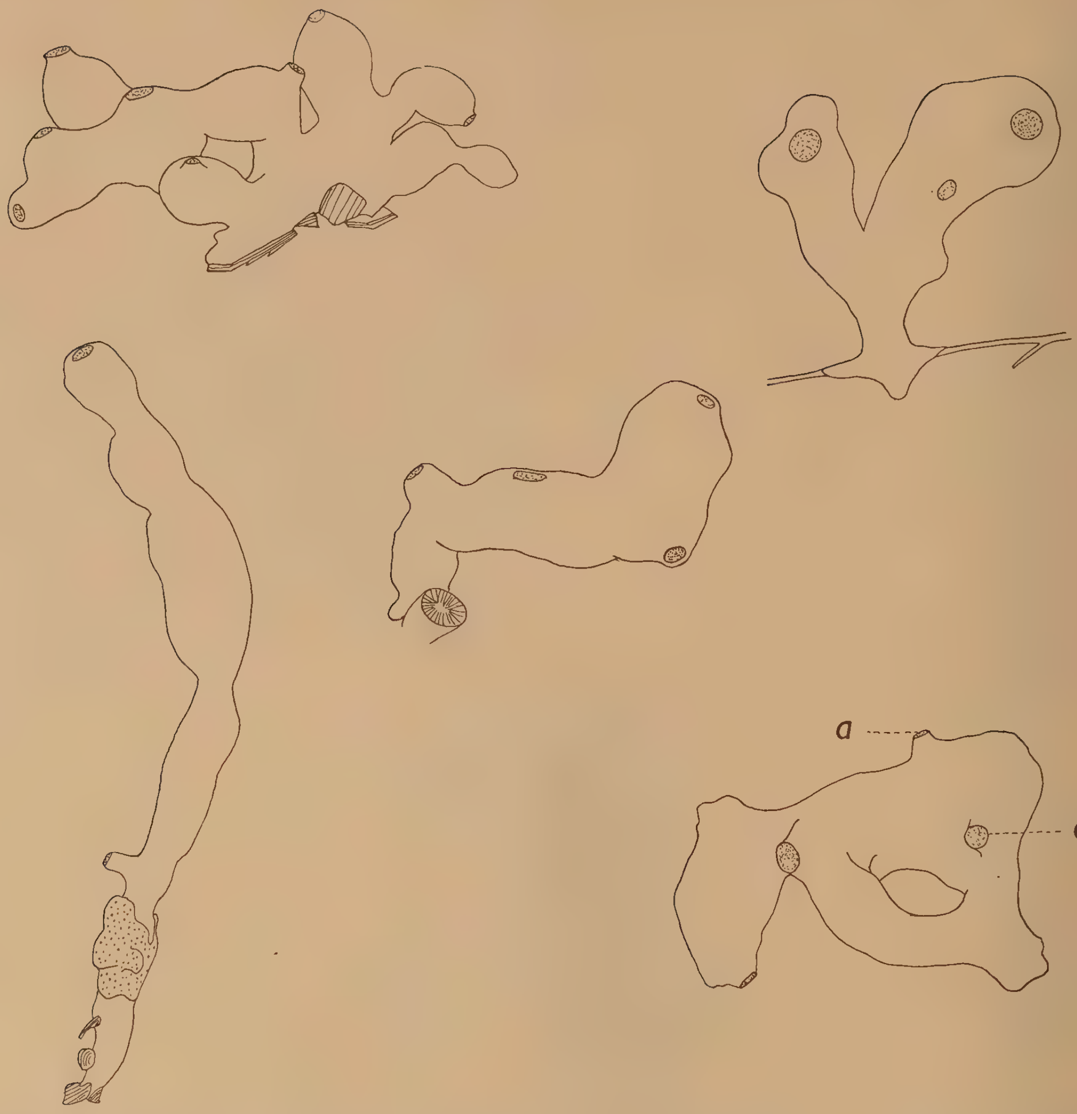

Fig. 13. *Callyspongia fortis* (Ridley). To show variation in form. All figures × $\frac{2}{3}$. For the sake of clearness the oscules are marked by dotted areas (*a* and *a′* are oscules not yet opened).

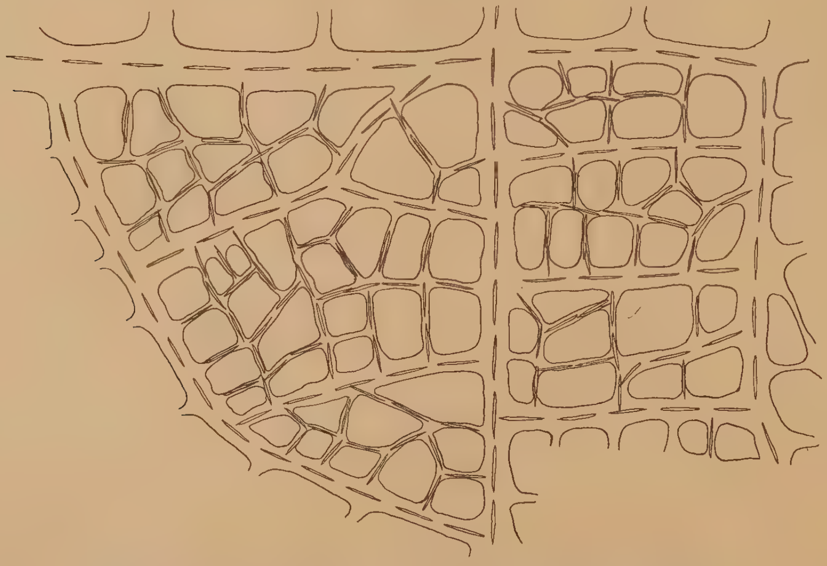

Fig. 14. *Callyspongia fortis* (Ridley). Portion of tangential dermal skeleton. × 100.

main skeleton contain only feebly developed spicules, measuring 0·052 by 0·002 mm., while the dermal skeleton contains only normal spicules, measuring 0·06 by 0·006 mm.

In the same way, the inadequacy of *Siphonochalina*, as a genus for the reception of all tubular Chalininae, is shown by the fact that, while the remainder of the specimens are sub-ramose or lobate, one is erect and tubular, with an apical osculum and a deep cloaca running the length of the body, and two accessory lateral oscula near the base.

DISTRIBUTION. Chile.

Callyspongia fusifera (Thiele) (Plate LII, fig. 1; Figs. 15, 16).

Chalina fusifera, Thiele, 1905, p. 476, figs. 15, 32, 95.

Occurrence. St. WS 77: Falkland Islands, 110–113 m.; St. WS 86: Falkland Islands, 157–147 m.

REMARKS. The specimen assigned to this species is palmo-digitate (see Plate LII, fig. 1) and comparison of the figure given with that given for the holotype (Thiele, *loc. cit.*, fig. 15) shows that the two specimens have a similar appearance although the shape is not identical. On the other hand, the arrangement of the dermal skeleton and the shape of the spicules differ considerably in the two specimens. Through the kindness of Dr W. Arndt, I have been able to examine a piece of the holotype and have found that the dermal skeleton is a close-meshed reticulation showing an incipient differentiation into primary and secondary meshes. The main skeleton is a coarse and large-meshed reticulation with multispicular primary fibres and unispicular secondary fibres. The spicules are 0·06 mm. long and rounded at the ends, although not forming pure strongyla. The dermal skeleton of the present specimen does not show so marked a differentiation into primary and secondary fibres even as the holotype. The main skeleton is a close-meshed reticulation with bispicular primary fibres and unispicular secondary fibres, and the dermal skeleton is echinated at the nodes by tufts of spicules projecting from the ends of the primary fibres of the main skeleton. The spicules are

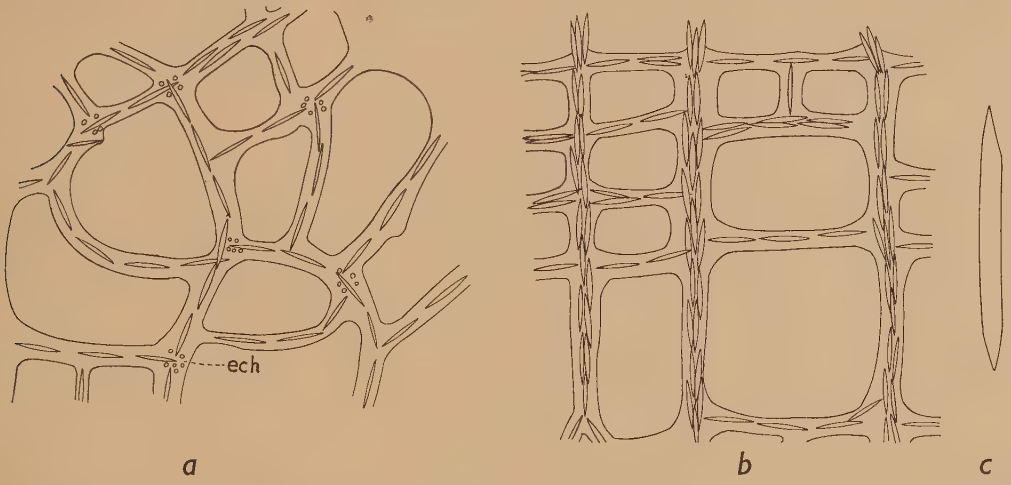

Fig. 15. *Callyspongia fusifera* (Thiele). Falkland Islands specimen. *a*, dermal skeleton, × 100; *b*, main skeleton, × 100; *c*, oxeote, × 400; *ech*, echinating tufts of spicules seen in section.

oxea measuring 0·14 by 0·01 mm. A comparison of Figs. 15 and 16 will show clearly the obvious way in which the skeleton of the present specimen differs from that of the type. In fact, there might be something to be said in favour of regarding the two specimens as specifically different, but for the fact that the differences they exhibit can be shown by comparison with the known variations in other species of *Callyspongia* to be unimportant, and also by the fact that the co-types of the species are to an extent intermediate between these two specimens. In the specimen from Calbuco, for example, the spicules are almost identical in shape with those of the Discovery specimen, though slightly smaller. Unfortunately, I have no information as to the structure of the skeleton in the co-types, but it is probable that intermediate characters will be found in this too. The co-type from Punta Arenas has oxea measuring 0·24 mm. long, considerably longer than those of the present specimen.

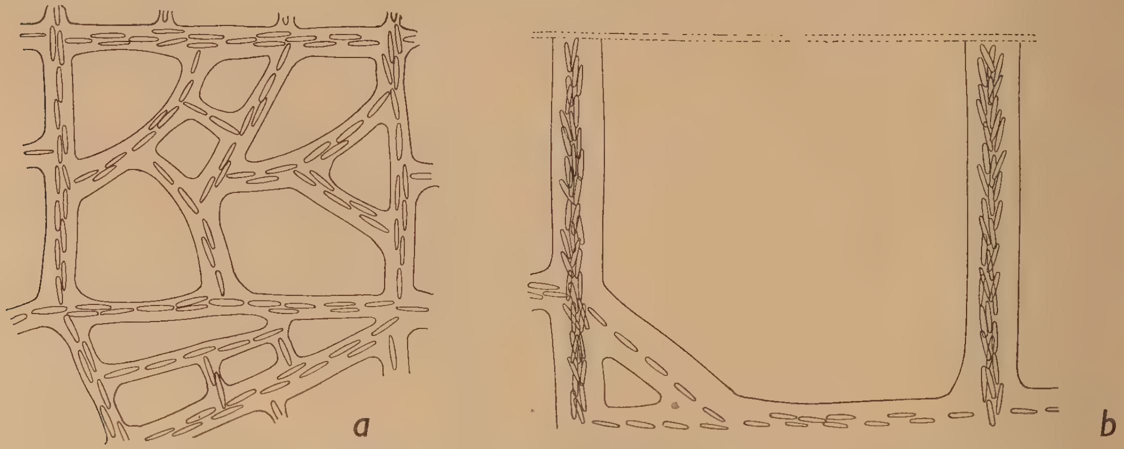

Fig. 16. *Callyspongia fusifera* (Thiele). Holotype. *a*, dermal skeleton, × 66; *b*, main skeleton, × 66.

Distribution. Calbuco; Tumbes; Punta Arenas.

Callyspongia flabellata, sp.n. (Plate XLIX, fig. 4; Fig. 17).

Holotype. B.M. 28. 2. 15. 359.

Occurrence. St. WS 81: Falkland Islands, 81–82 m.

Diagnosis. Sponge flabellate, pedunculate; surface even, minutely hispid; oscules numerous, 1–2 mm. in diameter, mainly disposed in an irregular linear series along margins of sponge; pores apparently distributed generally over surface; colour, in spirit, greyish yellow; main skeleton irregularly isodictyal, uni- or multispicular; dermal skeleton a tangential network of fibres, similar to those of main skeleton, echinated at nodes by tufts of spicules projecting at right angles; spicules oxea, straight, smooth, 0·105 by 0·009 mm.

Remarks. The dermal skeleton is not easily detected. It cannot be readily removed, as is usual in other Chalininae with a special dermal skeleton, and the fact that its nodes are echinated by tufts of spicules makes it appear as though the sponge were a true

Haliclona, devoid of special dermal skeleton and with the primary fibres of the main skeleton continued outwards beyond the ectosome. Sections of the sponge, taken at right angles to the surface, show, however, even to the naked eye, that there is a definite and unmistakable dermal skeleton. This is the more readily apparent since the interior of the sponge is cavernous and the ectosome compact and firm.

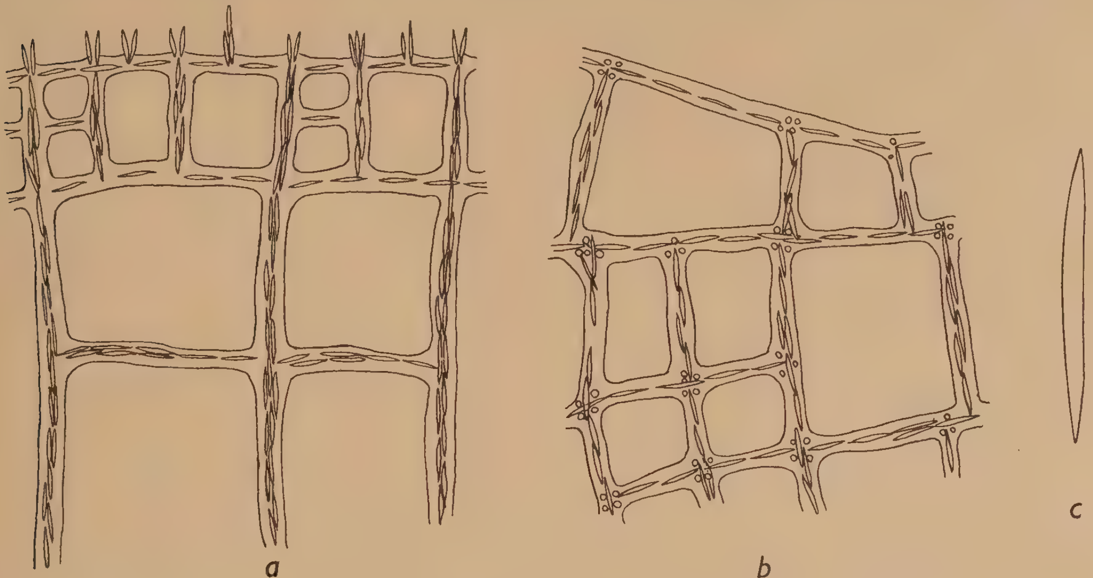

Fig. 17. *Callyspongia flabellata*, sp.n. *a*, section at right angles to surface, × 60; *b*, dermal skeleton, × 60; *c*, oxeote, × 400.

The species is characterized mainly by its external form.

Genus Phloeodictyon, Carter

Phloeodictyon eumitum, Kirkpatrick.

P. eumatum (*sic*), Kirkpatrick, 1903, p. 253, pl. v, fig. 18, pl. vi, fig. 19 (the name is spelt *eumitum* on p. 235, and in the explanation to the plates).

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

Distribution. Natal.

Family DESMACIDONIDAE

Section *ISODICTYEAE*

Genus Isodictya, Bowerbank

Isodictya kerguelensis (Ridley and Dendy).

Homoeodictya kerguelensis, Ridley and Dendy, 1886, p. 346; *id.*, 1887, p. 110, pl. xxiii, fig. 3, pl. xxiv, fig. 3; *Desmacidon kerguelensis*, Topsent, 1908, p. 24; *Homoeodictya kerguelensis*, *id.*, 1917, p. 67.

Occurrence. St. WS 79; Falkland Islands, 131–132 m.

Distribution. Kerguelen; Graham Land.

Isodictya kerguelensis, var. simillima (Hentschel).

Homoeodictya kerguelensis, var. *simillima*, Hentschel, 1914, p. 80, pl. vi, fig. 7.

Occurrence. St. WS 109; Falkland Islands, 145 m.

DISTRIBUTION. Wilhelm Land.

Isodictya setifer (Topsent).

Desmacidon setifer, Topsent, 1901, p. 6; *id.*, 1901, p. 17, pl. i, fig. 3, pl. iii, fig. 6; *Desmacidon spinigera*, Kirkpatrick, 1907, p. 283; *id.*, 1908, p. 39, pl. xix, fig. 3, pl. xxiii, fig. 3; *Desmacidon setifer*, Topsent, 1908, p. 26; *Homoeodictya verrucosa*, *id.*, 1913, p. 636, pl. v, fig. 1, pl. vi, fig. 13; *H. setifera*, *id.*, *loc. cit.*, p. 637; *H. obliquidens*, Hentschel, 1914, p. 79, pl. iv, fig. 7, pl. vi, fig. 6; *H. setifera*, *id.*, *loc. cit.*, p. 81; *H. setifera*, Topsent, 1917, p. 65, pl. vi, fig. 12; *H. trigona*, *id.*, *loc. cit.*, p. 66; *Desmacidon spinigera*, Brøndsted, 1926, p. 3; *Isodictya spinigera*, Burton, 1929, p. 424; *I. verrucosa*, *id.*, *loc. cit.*, p. 424.

Occurrence. St. 39: South Georgia, 179–235 m.; St. 42: South Georgia, 120–204 m.; St. 143: South Georgia, 273 m.; St. 144: South Georgia, 155–178 m.; St. 148: South Georgia, 132–148 m.; St. 149: South Georgia, 200–234 m.; St. 159: South Georgia, 160 m.; St. 160: Shag Rocks, 177 m.; St. 175: South Shetlands, 200 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 73: Falkland Islands, 121 m.; St. WS 77: Falkland Islands, 110–113 m.; St. WS 80: Falkland Islands, 152–156 m.; St. WS 81: Falkland Islands, 81–82 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 88: Falkland Islands, 96–127 m.; St. WS 99: Falkland Islands, 251–225 m.; St. WS 109: Falkland Islands, 145 m.; St. WS 239: Falkland Islands, 196–193 m.; St. WS 243: Falkland Islands, 144–141 m.; St. WS 246: Falkland Islands, 267–208 m.; St. WS 248: Falkland Islands, 210–242 m.

REMARKS. There are 32 specimens in the collection which belong, in my opinion, to the same species, namely *Isodictya setifer* (Topsent). They all resemble each other strongly externally, and have much the same appearance as that of the holotype of *Homoeodictya verrucosa*, Topsent (1913, pl. v, fig. 1). The form is massive to lobose, often stipitate. In spiculation they agree also in having a main skeleton of oxea and, for microscleres, isochelae palmatae, which have the peculiarity that they are often contorted and distorted and the palms are sometimes obliquely directed. This peculiarity of the microscleres has been overlooked in many cases, as for example in *Desmacidon spinigera*, Kirkpatrick, although Topsent and Hentschel drew attention to it in *Desmacidon setifer* and *Homoeodictya obliquidens* respectively. The reason for this seems to be that the contortion and distortion are most marked in the smaller spicules, that is in those least easily seen, and will only be noticed if the microscleres are numerous and the eye happens to catch one in an isolated position in the preparation lying in a particularly favourable angle for examination. At all events, I have satisfied myself that such microscleres are present in the type of *Desmacidon spinigera*, Kirkpatrick, and that they are present in varying proportions in the specimens of the present collection. It often happens, of course, that a particular individual may have a greater proportion of normal chelae than abnormal, and were one not looking particularly for contorted or distorted microscleres these would be completely overlooked. I have no doubt therefore that in the types of *Homoeodictya verrucosa*, Topsent, and other species in the above list of synonyms in which abnormal chelae have not been recorded, these same peculiar chelae are present, though probably in small quantities.

With regard to the types of *Desmacidon setifer*, *D. spinigera*, *Homoeodictya trigona*, *H. verrucosa* and *H. obliquidens* we may say that in external appearance there is literally nothing to choose between them. In the arrangement of the spicules in the main skeleton there is the same similarity, and in the shape of the microscleres there are the same peculiarities. It is only in the dimensions of the spicules, and more particularly of the megascleres, that distinctions may be made between them. The dimensions of the spicules are as follows:

	Oxea (mm.)	Chelae (mm.)
D. setifer	0·880–1·0	0·023–0·03
D. spinigera	0·731	0·024
H. trigona	0·740	0·060–0·07
H. verrucosa	0·52	0·027–0·037
H. obliquidens	0·528–0·672	0·038–0·055

The variation in the dimensions of the oxea in these five forms is from 0·52 to 1·0 mm., and in the chelae from 0·023 to 0·07 mm. This, on the face of it, is quite a considerable range. On the other hand, the five forms afford a convenient series of intermediates from one extreme of measurement to the other, both in the oxea and in the chelae, and it is obvious that if a large collection of specimens were examined and an attempt made to divide them into species on the basis of spicule measurement, the attempt would prove to be impossible. This is actually what has happened in the case of the Discovery specimens, in which the average measurements of the spicules range as follows: oxea 0·35–0·7 by 0·01–0·025 mm., and chelae 0·028–0·06 mm. chord.

From direct observation and comparison of the 32 specimens of the present collection, I have no doubt whatsoever that they are all conspecific: and since the range of variation in the dimensions of their spicules is the same, or practically the same, as that found in the five species tabulated above, especially in view of the strong resemblance these five species have to each other in all other respects, I can see no alternative to regarding them as synonymous, even though it means the admission that the oxea in this species may have the surprisingly wide range of dimensions shown, from 0·35 to 1·0 mm., and that the chelae may vary from 0·023 to 0·07 mm.

DISTRIBUTION. Wilhelm Land; Victoria Land; Graham Land; Falkland Islands.

Isodictya delicata (Thiele).

Desmacidon delicata, Thiele, 1905, p. 435, figs. 1, 55.

Occurrence. St. WS 109: Falkland Islands, 145 m.

DISTRIBUTION. Admiralty Sound.

Isodictya antarctica (Kirkpatrick) (Plate LI, fig. 4).

Desmacidon kerguelensis, var. *antarctica*, Kirkpatrick, 1908, p. 37, pl. xix, fig. 1, pl. xxiii, fig. 1.

Occurrence. St. 42: South Georgia, 120–204 m.; St. 155: South Georgia, 260 m.; St WS 73: Falkland Islands, 121 m.; St. WS 83: Falkland Islands, 137–129 m.

DISTRIBUTION. Victoria Land.

Isodictya cactoides (Kirkpatrick).

Desmacidon kerguelensis, var. *cactoides*, Kirkpatrick, 1908, p. 38, pl. xix, fig. 2, pl. xxiii, fig. 2; *Isodictya cactoides*, Burton, 1929, p. 424.

Occurrence. St. 39: South Georgia, 179–235 m.; St. 123: South Georgia, 230–250 m.; St. 190: Palmer Archipelago, 93–130 m.; St. MS 68: South Georgia, 220–247 m.

DISTRIBUTION. Victoria Land.

Isodictya microchela (Topsent) (Plate LI, fig. 5).

Homoeodictya microchela, Topsent, 1915, p. 37.

Occurrence. St. WS 86: Falkland Islands, 151–147 m.

REMARKS. The original description of this species is unaccompanied by any illustration, so that it can only be identified with hesitation. The present specimen appears to belong to it, but if the identification is correct then the external form of this species is that shown in Plate LI, fig. 5.

DISTRIBUTION. Burdwood Bank.

Isodictya erinacea (Topsent).

Homoeodictya erinacea, Topsent, 1916, p. 169; *H. kirkpatricki*, *id.*, *loc. cit.*, p. 169; *H. erinacea*, *id.*, 1917, p. 68, pl. iii, fig. 1, pl. vi, fig. 15; *H. kirkpatricki*, *id.*, *loc. cit.*, p. 70, pl. i, fig. 2, pl. vi, fig. 14; *Desmacidon doryphora*, Brøndsted, 1926, p. 2, figs. 1, 2.

Occurrence. St. 190: Palmer Archipelago, 93–130 m.

REMARKS. In view of the strong likeness in other respects, I cannot accept the separation of *Homoeodictya kirkpatricki* and *Desmacidon doryphora* merely on account of the difference in the sizes of their respective megascleres, for that is the only character in which they differ. Under *Isodictya setifer* (see above), I have shown how much the dimensions of the spicules may vary within a single species of *Isodictya*, and the evidence from this source alone is sufficient to justify the identification of Brøndsted's species with that of Topsent. With regard to *Homoeodictya erinacea*, there is so much resemblance to the two other species that it is not possible to regard the mere presence of raphides or of tiny bosses on the chelae as characters necessitating a specific distinction.

DISTRIBUTION. Graham Land; Victoria Land.

Isodictya toxophila, sp.n. (Plate LII, figs. 2, 3; Plate LIII, figs. 1, 2; Fig. 18).

Holotype. B.M. 28. 2. 15. 158.

Occurrence. St. 39: South Georgia, 179–235 m.; St. 148: South Georgia, 132–148 m.; St. 175: South Shetlands, 200 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 27: South Georgia, 106–109 m.

Diagnosis. Sponge irregularly massive, with large oscules, or sub-infundibular with one side oscular, bearing oscules up to 2 mm. diameter, and other side poral, thrown in irregular folds; surface hispid, often verrucose; texture firm, compressible; colour, in spirit, yellow to brown; skeleton sub-isodictyal, with primary fibres 12–20 spicules thick, secondary fibres loose or represented by irregularly scattered single spicules; oxea 0·42 by 0·02 mm.; chelae 0·06 mm. chord; toxa up to 0·175 mm. long.

Remarks. The species, which is characterized mainly by the possession of toxa in addition to isochelae, shows a similar range in external form to that found in *Haliclona bilamellata* (see p. 267). The microscleres are very variable in their occurrence, the toxa are often very rare, and in one specimen no microscleres at all could be found.

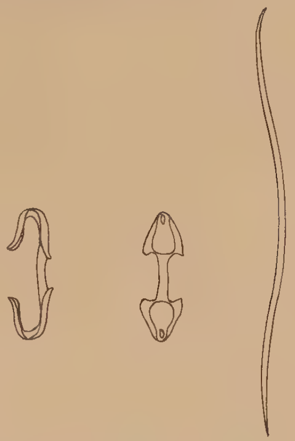

Fig. 18. *Isodictya toxophila*, sp.n. Microscleres, × 300.

Genus Guitarra, Carter

Guitarra fimbriata, Carter.

(For synonymy see Burton, 1929, p. 426.)

Occurrence. St. 39: South Georgia, 179–235 m.; St. WS 79: Falkland Islands, 131–132 m.; St. WS 86: Falkland Islands, 151–147 m.; St. WS 223: Falkland Islands, 114 m.; St. WS 243: Falkland Islands, 144–141 m.

Distribution. Arctic, Atlantic and Antarctic; Indian Ocean; New Zealand.

Genus Cercidochela, Kirkpatrick

Cercidochela lankesteri, Kirkpatrick.

C. lankesteri, Kirkpatrick, 1907, p. 284; *id.*, 1908, p. 42, pl. xix, fig. 5, pl. xxiii, fig. 5; Hentschel, 1914, p. 74; Burton, 1929, p. 426, pl. v, fig. 8.

Occurrence. St. 187: Palmer Archipelago, 259 m.

Distribution. Victoria Land; Wilhelm Land.

Genus Plumocolumella, Burton

Plumocolumella maeandrina (Kirkpatrick).

Desmacidon maeandrina, Kirkpatrick, 1907, p. 282; *id.*, 1908, p. 40, pl. xix, fig. 4, pl. xxiii, fig. 4; *Plumocolumella maeandrina*, Burton, 1929, p. 425.

Occurrence. St. 27: South Georgia, 110 m.; St. 42: South Georgia, 120–204 m.; St. 123: South Georgia, 160 m.; St. 148: South Georgia, 132–148 m.; St. 149: South Georgia, 200–234 m.; St. 158: South Georgia, 401–411 m.; St. WS 27: South Georgia, 106–109 m.; St. WS 33: South Georgia, 130 m.

Distribution. Victoria Land.

Plumocolumella myxillioides, sp.n. (Plate LIII, figs. 3, 4).

Holotype. B.M. 28. 2. 15. 321.

Occurrence. St. WS 79: Falkland Islands, 131–132 m.; St. WS 80: Falkland Islands, 152–156 m.; St. WS 81: Falkland Islands, 81–82 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 86: Falkland Islands, 151–147 m.; St. WS 88: Falkland Islands, 96–127 m.; St. WS 243: Falkland Islands, 144–141 m.; St. WS 246: Falkland Islands, 267–208 m.; St. WS 248: Falkland Islands, 210–242 m.

DIAGNOSIS. Sponge erect, arborescent with flattened anastomosing branches or sublamellate; surface smooth and even, bearing a conspicuous veining due to large subdermal canals showing through a transparent dermis; numerous circular depressions, scattered singly or in groups generally over surface, which probably bear both inhalant and exhalant apertures; colour, in spirit, yellow; skeleton, composed of irregular wisp-like bundles of tornota running longitudinally through branches, often forming a dense axial core, and bending towards surface or send off lateral branches to end in dermal brushes; tornota of main skeleton usually straight and smooth, with ends evenly and gradually pointed, frequently hastate or mucronate, measuring 0·3 by 0·006 mm.; isochelae arcuatae(?), 0·03 mm. chord.

Section *MYCALEAE*

Genus Mycale, Gray

Mycale magellanica (Ridley).

Esperia magellanica, Ridley, 1881, p. 117, pl. x, fig. 5; *E. cunninghami*, Carter, 1882, p. 300, pl. xi, fig. 17; *Esperella magellanica*, Ridley and Dendy, 1887, p. 67; *Mycale magellanica*, Thiele, 1905, p. 442; *Mycale* sp., *id.*, *loc. cit.*, p. 443, fig. 61: *Mycale* sp., Kirkpatrick, 1908, p. 37; *M. magellanica*, Topsent, 1913, p. 632, pl. iv, fig. 4, pl. vi, fig. 10; *M. pellita*, *id.*, *loc. cit.*, p. 633, pl. v, fig. 2; *M. antarctica*, Hentschel, 1914, p. 58, pl. v, fig. 7; *M. rossi*, *id.*, *loc. cit.*, p. 59, pl. v, fig. 8; *M. magellanica*, Dendy, 1924, p. 336; *M. lillei*, *id.*, *loc. cit.*, p. 337.

Occurrence. St. 53: Falkland Islands, 0–2 m.; St. 55: Falkland Islands, 10–16 m.; St. 146: South Georgia, 728 m.; St. 175: South Shetlands, 200 m.; St. WS 73: Falkland Islands, 121 m.; St. WS 82: Falkland Islands, 140–144 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 87: Falkland Islands, 96–127 m.; St. WS 90: Tierra del Fuego, 82–81 m.; St. WS 177: South Georgia, 97 m.; St. WS 210: Falkland Islands, 161 m.; St. WS 213: Falkland Islands, 249–239 m.; St. WS 222: Falkland Islands, 100–106 m.; St. WS 225: Falkland Islands, 162–161 m.; St. WS 233, Falkland Islands, 185–175 m.; St. WS 239: Falkland Islands, 196–193 m.; St. WS 244: Falkland Islands, 253–247 m.; St. WS 246: Falkland Islands, 267–208 m.; St. WS 247: Falkland Islands, 172 m.; St. WS 248: Falkland Islands, 210–242 m.; St. WS 249: Falkland Islands, 166 m.; St. WS 250: Falkland Islands, 251–313 m.

REMARKS. The synonymy of *M. magellanica* will be dealt with fully in a report, to be published shortly, on the collections of the Swedish Antarctic Expedition. One point only need be noted here in connection with this species, that a single specimen from St. WS 222, otherwise typical, is entirely without microscleres.

DISTRIBUTION. Southern extremity of South America; Graham Land; Victoria Land; Wilhelm Land.

Mycale lapidiformis (Ridley and Dendy).

Esperella lapidiformis, Ridley and Dendy, 1886, p. 338; *id.*, 1887, p. 64, pl. xv, figs. 2, 10, pl. xvi, fig. 2.

Occurrence. St. WS 248: Falkland Islands, 210–242 m.

DISTRIBUTION. Mouth of Rio de la Plata.

Mycale acerata, Kirkpatrick.

M. acerata, Kirkpatrick, 1907, p. 280; *id.*, 1908, p. 36, pl. xx, fig. 1, pl. xxiv, fig. 10; *M. acerata*, var. *minor*, Hentschel, 1914, p. 63; *M. acerata*, Topsent, 1917, p. 63; Burton, 1929, p. 430.

Occurrence. St. 42: South Georgia, 120–204 m.; St. 45: South Georgia, 238–270 m.; St. 159: South Georgia, 160 m.; St. 164: South Orkneys, 24–36 m.; St. 175: South Shetlands, 200 m.

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land.

Mycale tridens, Hentschel.

M. tridens, Hentschel, 1914, p. 56, pl. v, fig. 6; Topsent, 1917, p. 63; Burton, 1929, p. 430.

Occurrence. St. 170: Clarence Island, 342 m.; St. MS 71: East Cumberland Bay, South Georgia, 110–60 m.

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land.

Mycale macrochela, sp.n. (Plate LI, fig. 6).

Holotype. B.M. 28. 2. 15. 827.

Occurrence. St. 170: Clarence Island, 342 m.

DIAGNOSIS. Sponge lamellar with large oscules, up to 8 mm. in diameter and with conspicuous membranous collar, scattered over one surface; surface even, minutely hispid; texture firm, friable; colour, in spirit, dark greenish grey; skeleton a loose reticulation of bundles of subtylostyli, with brushes of subtylostyli at surface; subtylostyli 0·53 by 0·017 mm.; anisochelae 0·07, 0·035 and 0·022 mm. chord; sigmata 0·1 mm. chord; trichodragmata 0·035 mm. long.

REMARKS. The species is remarkable for its plate-like external form and for the form of the anisochelae. It resembles *M. simonis*, from South Africa, most closely in the form of the anisochelae, but differs considerably from this species in all other respects.

Genus **Amphilectus**, Vosmaer

Amphilectus fucorum (Esper) (Plate LIV, figs. 1–4).

Spongia fucorum, Esper, 1794, p. 278, pl. xlix, figs. 1, 2; *S. parasitica*, Montagu, 1818, p. 114; Gray, 1821, p. 360; Grant, 1826, p. 348; *Halichondria parasitica*, Flemming, 1828, p. 521; *Halispongia parasitica*, Blainville, 1834, p. 532; *Halichondria parasitica*, Bellamy, 1839, p. 268; Thompson, 1840, p. 254; *H. fucorum*, Johnston, 1842, p. 112, pl. ix, pl. xii, fig. 2; *Isodictya normani*, Bowerbank, 1866, p. 320; *I. fucorum*, *id.*, *loc. cit.*, p. 322; *I. alderi*, *id.*, *loc. cit.*, p. 323; *I. edwardii*, *id.*, *loc. cit.*, p. 325; *I. paupera*, *id.*, *loc. cit.*, p. 328; *I. uniformis*, *id.*, *loc. cit.*, p. 329; *I. clarkei*, *id.*, *loc. cit.*, p. 330; *I. gracilis*, *id.*, *loc. cit.*, p. 331; *I. normani*, Gray, 1867, p. 534;

I. paupera, Parfitt, 1868, p. 8; *I. uniformis*, Bowerbank, 1874, p. 139, pl. lv, figs. 8–10; *I. normani*, *id.*, *loc. cit.*, p. 141, pl. lvi, figs. 1–5; *I. clarkei*, *id.*, *loc. cit.*, p. 142, pl. lvi, figs. 11–15; *I. fucorum*, *id.*, *loc. cit.*, p. 142, pl. lvi, figs. 16–19; *I. alderi*, *id.*, *loc. cit.*, p. 143, pl. lvi, figs. 20–26; *I. edwardii*, *id.*, *loc. cit.*, p. 148, pl. lviii, figs. 15–18; *I. gracilis*, *id.*, *loc. cit.*, p. 149, pl. lviii, figs. 23–26; *I. imitata*, *id.*, *loc. cit.*, p. 223, pl. lxxvi, figs. 3–6; *I. invalida*, *id.*, *loc. cit.*, p. 285, pl. lxxxv, figs. 8–10; *I. dubia*, *id.*, *loc. cit.*, p. 323, pl. xc, figs. 4–7; *Hymeniacidon callosus*, Bowerbank, 1882, p. 86, pl. iv, figs. 6–8; *Amphilectus gracilis*, Vosmaer, 1880, p. 111; *A. compressus*, *id.*, *loc. cit.*, p. 112; *A. dubius*, *id.*, *loc. cit.*, p. 112; *A. imitatus*, *id.*, *loc. cit.*, p. 116; *A. fucorum*, *id.*, *loc. cit.*, p. 117; *A. normani*, *id.*, *loc. cit.*, p. 117; *A. clarkei*, *id.*, *loc. cit.*, p. 119; *Isodictya gracilis*, Bowerbank, 1882, p. 136; *I. invalida*, *id.*, *loc. cit.*, p. 136; *I. normani*, *id.*, *loc. cit.*, p. 136; *I. hispida*, *id.*, *loc. cit.*, p. 136, pl. xii, figs. 1–5; *I. alderi*, *id.*, *loc. cit.*, p. 138; *I. edwardii*, *id.*, *loc. cit.*, p. 138; *I. fucorum*, *id.*, *loc. cit.*, p. 138; *I. clarkei*, *id.*, *loc. cit.*, p. 139; *I. paupera*, *id.*, *loc. cit.*, p. 139; *I. uniformis*, *id.*, *loc. cit.*, p. 139; *I. dubia*, *id.*, *loc. cit.*, p. 140; *I. imitata*, *id.*, *loc. cit.*, p. 141; *I. involuta*, *id.*, *loc. cit.*, p. 143, pl. x, figs. 1–4; *I. pertenuis*, *id.*, *loc. cit.*, p. 144, pl. xiii, figs. 1–4; *I. scitula*, *id.*, *loc. cit.*, p. 146, pl. iv, figs. 1–3, pl. ix, figs. 1–3; *Esperia normani*, Fristedt, 1885, p. 42; *Reniera fucorum*, Topsent, 1888, p. 148; *R. paupera*, *id.*, *loc. cit.*, p. 148; *R. uniformis*, *id.*, *loc. cit.*, p. 149; *Stylinos uniformis*, *id.*, 1891, p. 535; *Esperiopsis normani*, Lundbeck, 1905, p. 13, pl. viii, fig. 2; *Esperiopsis* sp., *id.*, *loc. cit.*, p. 15, pl. viii, fig. 3; *E. edwardii*, Thiele, 1905, p. 441; *E. fucorum*, Stephens, 1912, p. 36; *E. edwardii*, Hentschel, 1914, p. 69; *E. informis*, Stephens, 1915, p. 450, pl. xi, fig. 11; *E. fucorum*, Stephens, 1921, p. 17; *E. normani*, Brøndsted, 1923, p. 138, fig. 18; *E. crasso-fibrosa*, *id.*, *loc. cit.*, p. 139, fig. 19; *E. edwardii*, Dendy, 1924, p. 341; *E. normani*, Brøndsted, 1926, p. 5; *Amphilectus gracilis*, Burton, 1929, p. 428; *Axinosia incrustans*, Burton, 1930, p. 333, fig. 1.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.; St. 42: South Georgia, 120–204 m.; St. 51: Falkland Islands, 105–115 m.; St. 160: Shag Rocks, 177 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 229: Falkland Islands, 210–271 m.

DIAGNOSIS. Sponge polymorphic, encrusting, massive, or branching; surface even, minutely hispid; oscules inconspicuous in encrusting forms, small and scattered or large and crateriform in massive forms, small, often arranged in linear series in branching forms; skeleton isodictyal to sub-isodictyal; no special dermal skeleton; megascleres smooth, usually curved styli, 0·135–0·48 by 0·003–0·019 mm.; microscleres palmate isochelae, 0·014–0·028 mm.

REMARKS. Bowerbank, in his *Monograph of the British Spongiadae* (1866–82), described twelve species of *Isodictya* possessing styli and palmate anisochelae. All agree so very closely in spiculation that, judging from this aspect alone, there would be no hesitation in regarding them all as synonyms of a single species. Certain differences in their external appearance give rise, however, to a little hesitation in taking so drastic a step, and it is necessary to compare them from this point of view.

I. normani is massive with large, crater-like oscules, or encrusting with small, scattered oscules; colour (alive) unknown, (dried) fawn-yellow.

I. fucorum is massive with comparatively large, scattered oscules; colour (alive) "bright red or pink, to pale ash or brown".

I. alderi is encrusting, with inconspicuous oscules; colour (alive) faint red.

I. edwardii is encrusting, with inconspicuous oscules; colour (dried) "ochreous yellow".

I. paupera is encrusting, with inconspicuous oscules; colour (dried) "light ochreous yellow".

I. gracilis is ramose and branching, with small oscules; colour (alive) pale buff, (dried) cream white.

I. imitata is encrusting, with no visible oscules; colour (dried) "brown with tint of green".

I. dubia is encrusting, with no conspicuous oscules; colour (dried) "light grey with tint of yellow", (alive) orange.

I. hispida is encrusting, with no visible oscules; colour (dried) dark grey.

I. nodosa is massive, with fistulous oscules; colour (dried) light brown.

I. involuta is encrusting, with no apparent oscules; colour (dried) dark brown.

I. scitula is encrusting, with no apparent oscules; colour (dried) "light ochreous yellow".

With the exception of *I. gracilis*, there is nothing in the shape of these sponges to justify a segregation into different species. The colour records taken from the dried state may be ignored. In my experience, the result of drying, so far as colour is concerned, depends more on the manner in which the sponge is dried, than on the colour in the living condition. The records taken from living specimens show considerable variation in colour, but with a tendency to a reddish tint.

If any division is to be made it must take the form of separating the twelve species into two forms of a single species, a branching form, including *I. gracilis*, and a massive form including all the rest. Even so, it is probable that the two forms are purely ecological and that in the course of future investigations, all gradations between the two may be found.

The dimensions of the spicules of *Amphilectus fucorum*, as exemplified by the holotypes of the twelve species of *Isodictya* enumerated by Bowerbank, are: oxea 0·135–0·2 by 0·003–0·008 mm., and isochelae 0·014–0·018 mm.

Gray (*loc. cit.*), Vosmaer (*loc. cit.*) and Topsent (*loc. cit.*) add nothing new to our knowledge of these forms. Ridley (1883) described two specimens from Scotland, under *Amphilectus edwardii*, one of which was erect and branching and the other cylindrical. At the same time, he doubts the identity of *Isodictya gracilis* with *I. edwardii*, although his own specimens had the external form of the former. On the other hand, Levinsen (*loc. cit.*), Lundbeck (*loc. cit.*) and Stephens (1921) leave no doubt that *Esperiopsis fucorum* may be either encrusting or branched. Further, I have seen massive specimens from Plymouth, with large oscules, in which the surfaces were beset with numerous blunt processes, up to 2 cm. long, undoubtedly representing incipient branches. We may now assume, I think, that there is nothing peculiar about *Isodictya gracilis* and that it is a synonym of *Amphilectus fucorum*.

Numerous specimens of *Amphilectus fucorum* have been recorded, under various names, from the southern hemisphere which agree in external form with those of the northern hemisphere. They have this in common, however, that the styli are considerably larger in the southern forms and the chelae slightly so. The recorded measurements of the spicules are: Thiele (Falkland Islands), styli 0·225–0·26 by 0·01 mm., chelae 0·022 mm.; Hentschel (Kerguelen), styli 0·185–0·276 mm., chelae 0·019–0·022 mm.; Brøndsted (New Zealand), styli 0·2–0·29 by 0·007–0·008 mm., chelae 0·025 mm.; Dendy (New Zealand), styli 0·3 by 0·012 mm., chelae 0·028 mm. From this it is clear that Stephens' *Esperiopsis informis* is also a synonym of *Amphilectus fucorum*. In addition to those already referred to, I have found several small fragments of the same species among the Terra Nova collections which came to my notice too late to be included in my report on those collections. The distribution is thus extended to the Antarctic.

Of the eight specimens in the present collection, three are typical in form, the first (Plate LIV, fig. 4) being encrusting, the others (Plate LIV, figs. 1–3) massive with incipient branching processes. Of the remaining five, one is small and massive, the rest are large and massive, quite unlike anything hitherto recorded for the species. At the same time, the structure of the skeleton in all the specimens is the same, and is identical with that of the European forms of *A. fucorum*, and the size of the spicules very similar. The latter is in some cases greater than any hitherto recorded for the species. The dimensions are: styli 0·27–0·48 by 0·009–0·019 mm., the chelae 0·021–0·028 mm., the figures representing the range of average spicule size for the eight specimens.

There has been a tendency in the past to confuse *Esperiopsis edwardii*, var. *americana*, with the present species. I take the opportunity therefore to include a photograph of the typical form of the variety (Plate LIV, fig. 5). In all probability, *E. rugosa* and its var. *major* are synonyms of this form, which I propose to regard as a separate species, *Amphilectus americanus* (Ridley and Dendy), distinguished by its external form.

DISTRIBUTION. Europe; South Africa; Falklands; New Zealand; Antarctic.

Amphilectus rugosus (Thiele).

Esperiopsis rugosa, Thiele, 1905, p. 440, fig. 50; *E. rugosa*, var. *major*, Hentschel, 1914, p. 68; *Amphilectus rugosa*, var. *major*, Burton, 1929, p. 430.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.; St. WS 85: Falkland Islands, 79 m.

DISTRIBUTION. Calbuco, Chile; Victoria and Wilhelm Lands, Antarctic.

Amphilectus flabellata, sp.n. (Plate LIII, fig. 5).

Holotype. B.M. 28. 2. 15. 409.

Occurrence. St. WS 88: Falkland Islands, 96–127 m.

DIAGNOSIS. Sponge massively flabellate, erect; surface uneven, minutely conulose, hispid; oscules and pores not apparent; colour, in spirit, dark brown; skeleton a subisodictyal, usually triangular and unispicular, reticulation with occasional multispicular bands running irregularly through sponge; no special dermal skeleton; little or no spongin; megascleres smooth styli, usually slightly curved, 0·285 by 0·009 mm.; microscleres palmate isochelae of usual type, 0·015–0·024 mm. long.

REMARKS. The holotype resembles *Esperiopsis fucorum*, and other allied species, in the structure of the skeleton and in the size and shape of the spicules. It differs from them all in external form. The specimen is massively flabellate, 12 cm. high, 14 cm. across and 2 cm. thick.

Genus Biemna, Gray

Biemna chilensis, Thiele.

B. chilensis, Thiele, 1905, p. 434, fig. 54; *B. macrorhaphis*, Hentschel, 1914, p. 74, pl. vi, fig. 3.

Occurrence. St. 177: South Shetlands, 1080 m.; St. 187: Palmer Archipelago, 259 m.; St. WS 243: Falkland Islands, 144–141 m.

DISTRIBUTION. Calbuco, Chile; Wilhelm Land.

Genus Asbestopluma, Norman

Asbestopluma calyx, Hentschel.

A. calyx, Hentschel, 1914, p. 66, pl. iv, fig. 4, pl. v, fig. 11.

Occurrence. St. 156: South Georgia, 200–236 m.

DISTRIBUTION. Wilhelm Land.

Genus Arenochalina, Lendenfeld

The genus, established by Lendenfeld (1887, p. 821) for a single species *A. mirabilis*, possesses very slender subtylostyli, not oxea as originally stated, and according to Hallmann (1912, p. 252 footnote), possibly anisochelae. There are several specimens in the British Museum collection, identified by Lendenfeld, which if not actual type specimens are sufficiently representative of the species to serve in their stead. From these it is obvious that the species is a degenerate *Mycale*.

The second species which I propose to assign to the genus differs from the type species in the structure of the skeleton, but agrees in the shape of its megascleres. The two may possibly be unrelated, but they are sufficiently alike in some features to make it convenient to include them provisionally in the same genus, and the diagnosis is emended accordingly.

DIAGNOSIS. Reduced Mycaleae with main skeleton composed of very slender subtylostyli, having enlarged axial canals; skeleton either a sub-isodictyal network of spongin fibres cored by spicules, or composed of loose wisps of spicules running vertically to surface and branching and anastomosing *en route*; special dermal skeleton absent; microscleres, when present, palmate anisochelae, toxa or both.

Arenochalina incrustans, sp.n. (Fig. 19).

Holotype. B.M. 28. 2. 15. 360.

Occurrence. St. 2: Ascension Island, attached to buoy.

DIAGNOSIS. Sponge encrusting; surface smooth, slightly conulose; oscules and pores not visible; colour, in spirit, white; skeleton composed of wisps of spicules running more or less vertically to surface, branching and anastomosing as they go; outermost ends of wisps ending just below ectosome; little or no spongin; megascleres subtylostyli, occasionally almost stylote, 0·165 by 0·003 mm.; microscleres blunt-ended toxa, 0·07 by 0·002 mm.

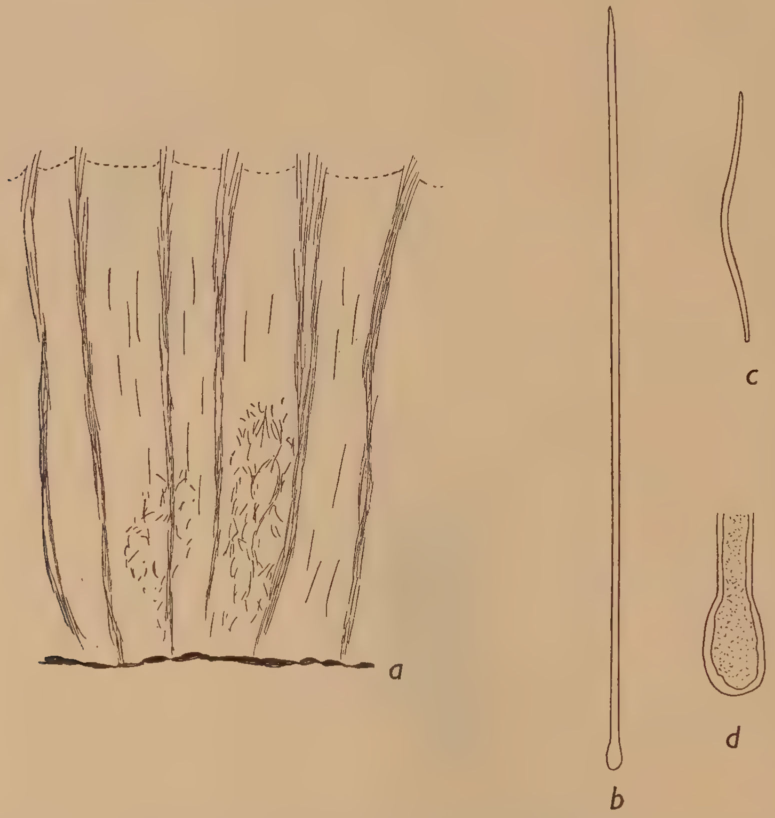

Fig. 19. *Arenochalina incrustans*, sp.n. *a*, section at right angles to surface, showing "nests" of toxa at centre, × 36; *b*, subtylostyle, × 500; *c*, toxon, × 500; *d*, base of subtylostyle, very much enlarged, to show relative size of axial canal.

Remarks. The species is evidently a degenerate *Mycale* but whether it represents a species in which the spiculation has become permanently degenerate, or whether it is an individual, with skeleton pathologically affected, of a species with more normal spiculation, it is impossible to say. At all events, the major part of a megasclere consists of the axial canal (Fig. 19 *d*).

The toxa are not distributed evenly throughout the tissues, as is usual, but are found in "nests" (Fig. 19 *a*).

Genus Acanthorhabdus, Burton

Acanthorhabdus fragilis, Burton.

A. fragilis, Burton, 1929, p. 432, pl. iv, fig. 2, text-fig. 5.

Occurrence. St. 170: Clarence Island, 342 m.

Distribution. Victoria Land.

Genus **Sigmotylotella**, gen.n.

Genotype. *S. suberitoides*, sp.n.

DIAGNOSIS. Mycaleae with main skeleton a confused reticulation of large tylostyli and dermal skeleton a palisade of small tylostyli set more or less at right angles to surface; microscleres sigmata.

REMARKS. The structure of the skeleton in *Sigmotylotella* resembles that of *Suberites* very closely, but the shape of the tylostyli and the presence of the sigmata definitely show it to be a member of the Mycaleae. It seems to be most nearly related to *Tylodesma*.

Sigmotylotella suberitoides, sp.n. (Fig. 20).

Holotype. B.M. 28. 2. 15. 400.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

DIAGNOSIS. Sponge encrusting; surface sparsely papillate, markedly hispid; oscules situated at apices of papillae; pores apparently distributed generally over surface; interior cavernous; texture firm but friable; colour, in spirit, black; main skeleton a confused reticulation of tylostyli of varying size arranged singly or in loose bundles; dermal skeleton a dense palisade of small tylostyli directed more or less at right angles to surface; tylostyli of main skeleton with curved shaft and well-developed spherical head, 1·0 by 0·018 mm.; tylostyli of dermal skeleton similar in shape to those of main skeleton, 0·6 by 0·012 mm.; microscleres simple contort sigmata, 0·028 mm. chord.

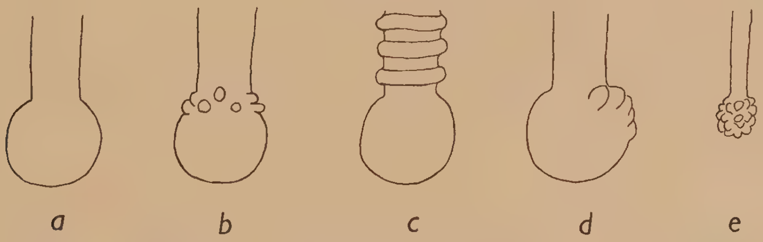

Fig. 20. *Sigmotylotella suberitoides*, sp.n. Tylostyli: *a*, normal; *b*, *d*, with tuberculate base; *c*, with annulate shaft; *e*, developmental form.

REMARKS. A curious feature of the spicules is that, very often, the bases of the tylostyli are tuberculate. This is more marked in the tylostyli of the dermal layer. Further, it is significant that the bases of developing spicules are also tuberculate (Fig. 20 *e*). Occasionally, a shaft may bear annular thickenings, and it is not improbable that this abnormality may be comparable with the tuberculations on the bases.

Section *IOPHONEAE*

Genus **Iophon**, Gray

Alebion, Gray, 1867, p. 534 (*nec* Kröyer): preoccupied; *Iophon*, Gray, 1867, p. 534 (genotype: *Halichondria scandens*, Bowerbank); *Pocillon*, Topsent, 1891, p. 539 (genotype: *Halichondria hyndmani*, Bowerbank); *Iophonopsis*, Dendy, 1924, p. 348 (genotype: *Halichondria nigricans*, Bowerbank); *Burtonella*, de Laubenfels, 1928, p. 361 (genotype: *Burtonella melanokhemia*, de Laubenfels).

REMARKS. The many attempts to establish a clear understanding of those species of *Halichondria*, described by Bowerbank, in which the spiculation consists of acanthostyli, tornota, anisochelae and bipocilla, have led to much confusion and a multiplication of generic names. Gray (*loc. cit.*) divided them between two genera, the first of which, *Alebion*, for *Halichondria hyndmani*, Bowerbank, was preoccupied (*Alebion*, Kröyer, 1863, Crustacea, *fide* Marschall, *Nomeclator Zoologicus*, 1873). The second, *Iophon*, for *Halichondria scandens*, Bowerbank, is here retained. Later, Topsent (*loc. cit.*) established the genus *Pocillon* for *Halichondria hyndmani*, which, as Dendy (*loc. cit.*) pointed out, is probably a synonym of *H. scandens*. *Pocillon* becomes therefore a synonym of *Iophon*. At the same time, Dendy proposed to divide the species of *Iophon* into two groups, retaining the name *Iophon* for the first and proposing the name *Iophonopsis* for those species without echinating acanthostyli. My own investigations have shown that some species are devoid of echinating acanthostyli during the early part of their life, but possess them later, and that in those species in which they normally occur these spicules may be only sparingly present or even absent from large tracts of the sponge. As the presence or absence of echinating acanthostyli are the only features by which a distinction between *Iophon* and *Iophonopsis* can be maintained, the use of the latter name must be abandoned. Such a variable character obviously cannot be used for purposes of generic distinction (cf. *Iophon chelifer*). And finally, *Burtonella* is a synonym of *Iophonopsis* and is here included in the list of synonyms of *Iophon*.

Iophon radiatus, Topsent.

(For synonymy see Burton, 1929, p. 442, and 1931, pp. 512–518.)

Occurrence. St. 123: South Georgia, 230–250 m.; St. 145: South Georgia, 26–35 m.; St. 170: Clarence Islands, 342 m.; St. 175: South Shetlands, 200 m.; St. 179: Palmer Archipelago, 4–10 m.; St. WS 33: South Georgia, 130 m.; St. WS 83: Falkland Islands, 137–129 m.

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land.

Iophon proximum (Ridley) (Plate LVII, figs. 1–13; Figs. 21–24).

Alebion proximum, Ridley, 1881, p. 119, pl. x, fig. 8; *Iophon chelifer*, Ridley and Dendy, 1886, p. 349; *I. pattersoni*, *id.*, 1887, p. 117; *I. chelifer*, *id.*, *loc. cit.*, p. 119, pl. xvi, fig. 3, pl. xvii, figs. 1, 3, 8; *I. chelifer*, Lambe, 1893, p. 30, pl. ii, fig. 7; *id.*, 1896, p. 191; *id.*, 1900, p. 23; *I. chelifer ostia-magna*, Wilson, 1904, p. 143, pl. xx, figs. 2, 4, 10, 11, pl. xxiv, fig. 1; *I. lamella*, *id.*, *loc. cit.*, p. 146, pl. xx, figs. 3, 7–9, 12, 13, pl. xxiv, figs. 2–4; *I. lamella indivisus*, *id.*, *loc. cit.*, p. 149, pl. xx, figs. 14–16; *I. chelifer*, Thiele, 1905, p. 445, fig. 63; *I. proximus* (*sic*) *reticularis*, Hentschel, 1914, p. 39.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.; St. 39: South Georgia, 179–235 m.; St. 42: South Georgia, 120–204 m.; St. 51: Falkland Islands, 105–115 m.; St. 157: South Georgia, 970 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 85: Falkland Islands, 79 m.; St. WS 128: Gough Island, 120–90 m.; St. WS 247: Falkland Islands, 172 m.

REMARKS. The Challenger specimens of *I. chelifer* exhibit a variability in spiculation totally unsuspected from the description given by Ridley and Dendy. The lectotype, *Iophon proximum* (Ridley): *Table showing known specimens in order of size, with details of external form and spiculation.*

Specimen	Shape	Size	Measurements of spicules in μ				
			Main acanthostyli	Echinating acanthostyli	Tornota	Anisochelae	Bipocilla
Alebion proximum, Ridley (type)	Encrusting	Less than 1 mm. thick	160 × 8	84 (abundant)	140 × 7	?–25 (very rare)	10 (extremely rare)
Iophon indentatus, Wilson (type)	Encrusting	0·5–1 mm. thick	220 × 15	Not recorded	220 × 8	14 (abundant)	8 (abundant)
*D 431**, St. 6	Encrusting	5 mm. thick	190 × 9	100 (rare)	210 × 4	9–28 (common)	14 (extremely rare)
Iophon proximus reticularis, Hentschel (type)	Encrusting	?	140 × 8	105 (rare)	175 × 5	18–24 (common)	Absent
D 740, St. WS 85	Massive	Fragmentary	190 × 14	105 (common)	190 × 6	17–23 (extremely abundant)	9 (common)
D 254, St. 51	Massive, with plicate surface	20 × 5 × 5 mm.	185 × 10	105 (uncommon)	200 × 7	?–32 (very rare)	11 (very rare)
D 252, St. 51	Irregularly massive	30 × 20 × 20 mm.	185 × 10	105 (common)	200 × 7	?–35 (very rare)	11 (rare)
D 430, St. WS 128	Massive with numerous foreign bodies incorporated	Fragmentary	200 × 8	100 (rare)	190 × 6	?–20 (very rare)	11 (rare)
D 256, St. 6	Massive	40 × 15 × 15 mm.	210 × 7	105 (occasional)	210 × 4	14–25 (very rare)	14 (common)
D 739, St. WS 247	Irregularly massive	30 × 30 × 10 mm.	200 × 14	105 (abundant)	175 × 6	14–28 (abundant)	11 (abundant)
D 251, St. 83	Massive	50 × 30 × 20 mm.	200 × 14	122 (common)	210 × 7	20–35 (common)	11 (common)
Iophon chelifer, Ridley and Dendy (lectotype)	Massive	Fragmentary	215 × 18	140	240 × 7	18–32 (abundant)	18 (abundant)
Iophon chelifer, Ridley and Dendy (cotype), B.M. 87. 5. 2. 158	Massive	?	370 × 14	Not seen	290 × 7	14–? (rare)	18 (abundant)
Iophon chelifer, Ridley and Dendy (cotype), B.M. 87. 5. 2. 157	Massive	Fragmentary	370 × 21	105 (rare)	300 × 9	14–32 (abundant)	12 (very common)
Iophon chelifer (Lambe's specimen)	Massive, subclathrate	80 × 50 mm.	300 × 16	Not recorded	250 × 7	29–36	13–18
Iophon pattersoni (Bowerbank), Challenger, St. 308	Massive	Fragmentary	210 × 14	105 (common)	210 × 6	?–28 (extremely rare)	7 (extremely abundant)
Iophon pattersoni (Bowerbank), Challenger, St. 311	Massive	Fragmentary	250 × 8	140 (rare)	210 × 4	14–38 (uncommon)	9 (abundant)
Iophon chelifer (Thiele's specimen)	Massive with digitate or tubular processes	80 mm. high	250 × 15	Not recorded	210 × 7	16–28	15
D 253, St. 51	Massive	30 × 30 × 25 mm.	185 × 12	105 (rare)	205 × 7	14–32 (common)	Not seen
D 258, St. 51	Flabellate	50 × 50 × 10 mm.	185 × 10	100 (rare)	200 × 4	17–32 (uncommon)	11 (common)
D 255, St. WS 83	Low-growing and massive or flabellate (?)	60 × 30 × 15 mm.	210 × 14	105 (common)	240 × 7	11–21 (rare)	11 (common)
Iophon lamella indivisus, Wilson (type)	Massive, spreading	40 × 40 mm.	210 × 14	Not recorded	230 × 7	12–28	8–10
Iophon chelifer ostia-magna, Wilson (type)	Massive, spreading	50 × 40 mm.	440 × 10	Not recorded	315 × 8	12–20	16–20
Iophon lamella, Wilson (type)	Massive, spreading	60 × 40 m.	210 × 14	Not recorded	230 × 7	14–28	12–16
G 109†	Massive to flabellate	Fragmentary	350 × 14	70 (very rare)	290 × 7	14–32 (common)	14 (common)
D 837, St. WS 83	Massive with plicate surface	70 × 30 × 40 mm.	185 × 12	Not seen	205 × 7	14–32 (common)	12 (common)
D 257, St. 51	Flabellate	Fragmentary: probably 100 × 100 × 30 mm. when complete	185 × 12	Not seen	205 × 7	14–32 (uncommon)	11 (uncommon)

* *D* = Discovery specimen: to complete the registered number entered in the British Museum catalogue, the number given here must be preceded by 28. 2. 15.

† *G* = Gilchrist's specimen: complete number = 04. 12. 1. 109.

B.M. 87. 5. 2. 116, takes the form of a number of dark brown fragments of a low-growing sponge with the surface thrown into numerous folds, resembling the adult form of *I. pattersoni.* The main acanthostyli have the same form as those of the juvenile stages of the same species (Fig. 23 *c*), while the echinating acanthostyli have much the same form as those of the adult forms (Fig. 21). The tornota are truncate at the ends where they are beset with a few spines (Fig. 22 *c*). Chelae are rare, but the characteristic trifoliate, occasionally bifoliate, bipocilla are present in abundance (Fig. 24 *c*). The second specimen, B.M. 87. 5. 2. 158, from Prince Edward Island, of which nothing remains except a microscopic preparation, has the same skeleton as the foregoing except that the anisochelae are more numerous and the acanthostyli slightly longer. The next specimen, B.M. 87. 5. 2. 157, the "young specimen" from the Cape of Good Hope (*fide* Ridley and Dendy 1887, p. 120), is an extremely thin crust growing on a piece of coral. In this the main acanthostyli are slightly longer than in the lectotype and are strongly spined throughout their length, more particularly at the base and at a point just below the apex (Fig. 23 *b*). Echinating acanthostyli are present and the tornota have an oval head at each end beset with numerous spines (Fig. 22 *b*). The latter, in addition to being scattered among the meshes of the main skeleton, also form a tangential skeleton in the dermis, where they are thickly packed but not arranged in a definite reticulation. Anisochelae, measuring 0·012–0·021 mm. long, are present, the larger being arranged in rosettes. The bipocilla bifoliate, but occasionally trifoliate with the smaller end multi-dentate, are sparingly present (Fig. 24 *b*).

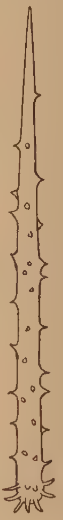

Fig. 21. *Iophon proximum* (Ridley): a typical echinating acanthostyle, × 400.

Lambe's (1893) specimens from Vancouver appear to be almost identical with the lectotype, while Thiele's (*loc. cit.*) differ apparently only in the smaller size of the acanthostyli. In both cases, however, no echinating acanthostyli were recorded. *I. chelifer ostia-magna*, Wilson, from the Galapagos Islands, differs in the larger size of the acanthostyli and tornota. Again no echinating acanthostyli are recorded. The external form, moreover, is lamellar. The same external form is found in a group of specimens presented to the British Museum by the late Dr Gilchrist, B.M. 04. 12. 1. 109, from the Natal coast, some of which are massive with low lamellate outgrowths and some purely lamellate.

Among the Discovery sponges are a number which approximate to the type of *I. chelifer* and must be considered in relation to it. In fact, despite obvious differences, it can be shown that they are actually conspecific with it and that these differences are merely fluctuating variations, perhaps ecological in origin.

These specimens vary from encrusting to irregularly massive, massive and spreading, sub-clathrate or flabellate (and erect). The surface in the massive specimens may be smooth, ridged, meandrine, plicate or bearing small flabellate processes. The colour is always dark brown and the texture friable. The skeleton is a sub-isodictyal reticulation of acanthostyli, echinated at the nodes by smaller acanthostyli, and the dermis is supported by a tangential layer of tornota. Anisochelae and bipocilla are present.

In all respects, these specimens appear to be conspecific, despite obvious differences in the shape and size of the acanthostyli and tornota and in the shape of the bipocilla; and this is even more clearly shown when they are compared with the specimens recorded under the various names included above as synonyms of *I. chelifer*. Nevertheless, it must be confessed that the species is an unusually variable one. The variation in external form is not particularly marked, but in the spicules it is, although the series of transitions which it is possible to construct leave no doubt as to the identity of all the specimens with a single species. Some of the variations can be correlated, but only vaguely, with increase in size, but nowhere is there so clearly marked a sequence as I have described (1930) in *I. radiatus*, Topsent. For example, with increase in size the specimen tends to become flabellate, either erect or spreading over the substratum; generally, the average size of the main acanthostyli and the tornota tends to increase, but the tendency is not well marked; the dermal skeleton is regular in young encrusting individuals and becomes more diffuse and irregular in the larger forms, but is never lost; and the bipocilla tend to become trifoliate (or bifoliate) as the specimen increases in size.

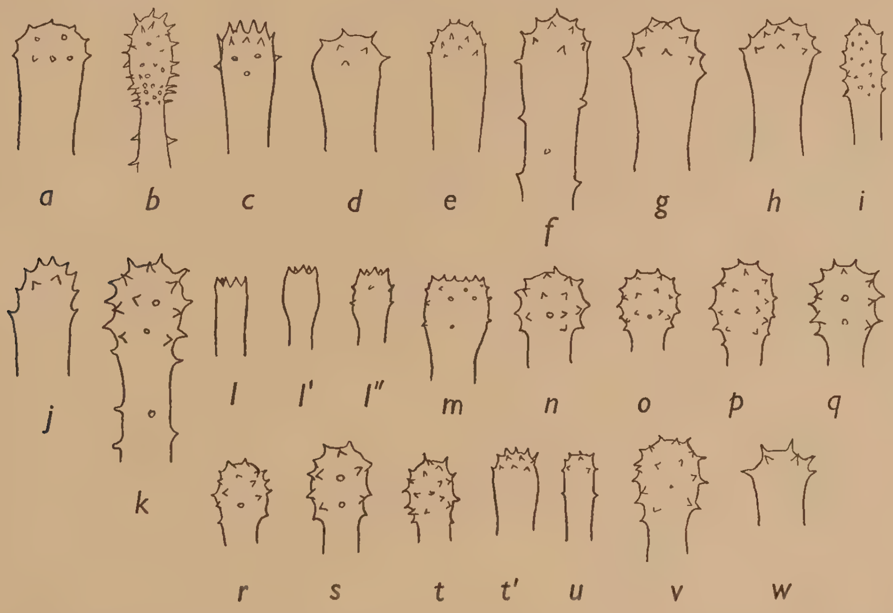

Fig. 22. *Iophon proximum* (Ridley): showing variation in ends of tornota. *a*, *I. chelifer ostia-magna*, Wilson (type); *b*, *I. chelifer*, Ridley and Dendy (co-type: B.M. 87. 5. 2. 157); *c*, *I. chelifer*, Ridley and Dendy (type); *d*, *I. chelifer*, Ridley and Dendy (Lambe's specimen); *e*, *G 109*; *f*, *I. indentatus*, Wilson (type); *g*, *I. lamella indivisus*, Wilson (type); *h*, *I. lamella*, Wilson (type); *i*, *I. pattersoni* (Bowerbank), Ridley and Dendy (Challenger Sts. 308 and 311); *j*, *I. chelifer*, Ridley and Dendy (Thiele's specimen); *k*, *D 255*; *l–l''*, *D 256*; *m*, *D 251*; *n*, *D 739*; *o*, *D 740*; *p*, *D 257*; *q*, *D 254*, *D 258*; *r*, *D 431*; *s*, *D 252*; *t*, *t'*, *D 837*; *u*, *D 430*; *v*, *Alebion proximum*, Ridley (type); *w*, *Iophon proximus* (Ridley), var. *reticularis*, Hentschel. All figures × 1200. Figs. *a*, *f*, *g*, *h* after Wilson; fig. *d* after Lambe; fig. *j* after Thiele. Fig. *w* from a preparation from the type.

Other interesting features of the skeleton are: (1) the frequency with which the

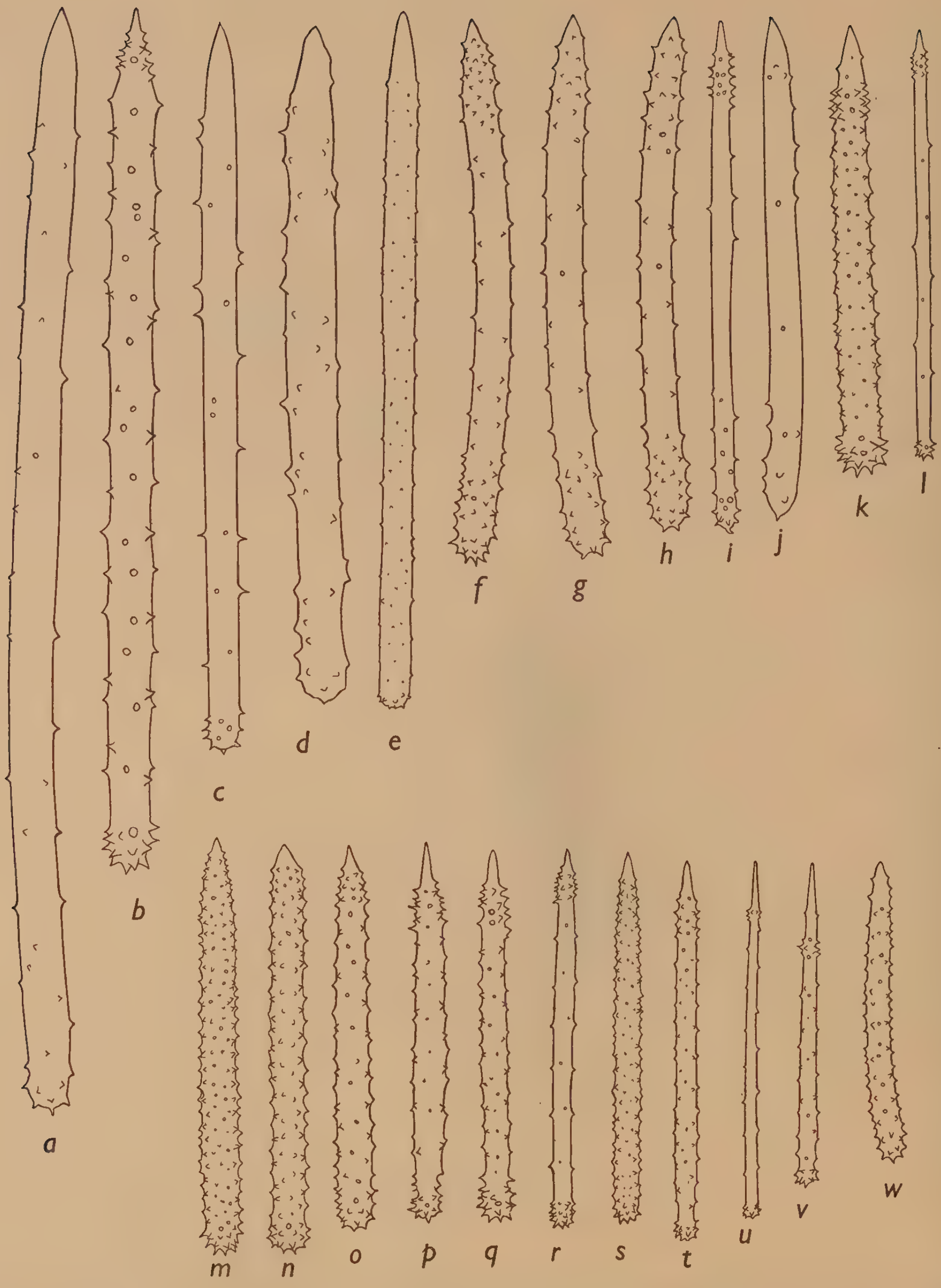

Fig. 23. *Iophon proximum* (Ridley), showing variation in size and shape of the main acanthostyli. *a*, *I. chelifer ostia-magna*, Wilson (type); *b*, *I. chelifer*, Ridley and Dendy (co-type: B.M. 87. 5. 2. 157); *c*, *I. chelifer*, Ridley and Dendy (type); *d*, *I. chelifer*, Ridley and Dendy (Lambe's specimen); *e*, *G 109*; *f*, *I. indentatus*, Wilson (type); *g*. *I. lamella indivisus*, Wilson (type); *h*, *I. lamella*, Wilson (type); *i*, *I. pattersoni* (Bowerbank), Ridley and Dendy (Challenger Sts. 308 and 311); *j*, *I. chelifer*, Ridley and Dendy (Thiele's specimen); *k*, *D 255*; *l*, *D 256*; *m*, *D 251*; *n*, *D 739*; *o*, *D 740*; *p*, *D 257*; *q*, *D 254*, *D 258*; *r*, *D 431*; *s*, *D 252*; *t*, *D 837*; *u*, *D 430*; *v*, *Alebion proximum*, Ridley (type); *w*, *Iophon proximus* (Ridley), var. *reticularis*, Hentschel. All figures × 300. Figs. *a*, *f*, *g*, *h* after Wilson; fig. *d* after Lambe; fig. *j* after Thiele. Fig. *w* from a preparation from the type.

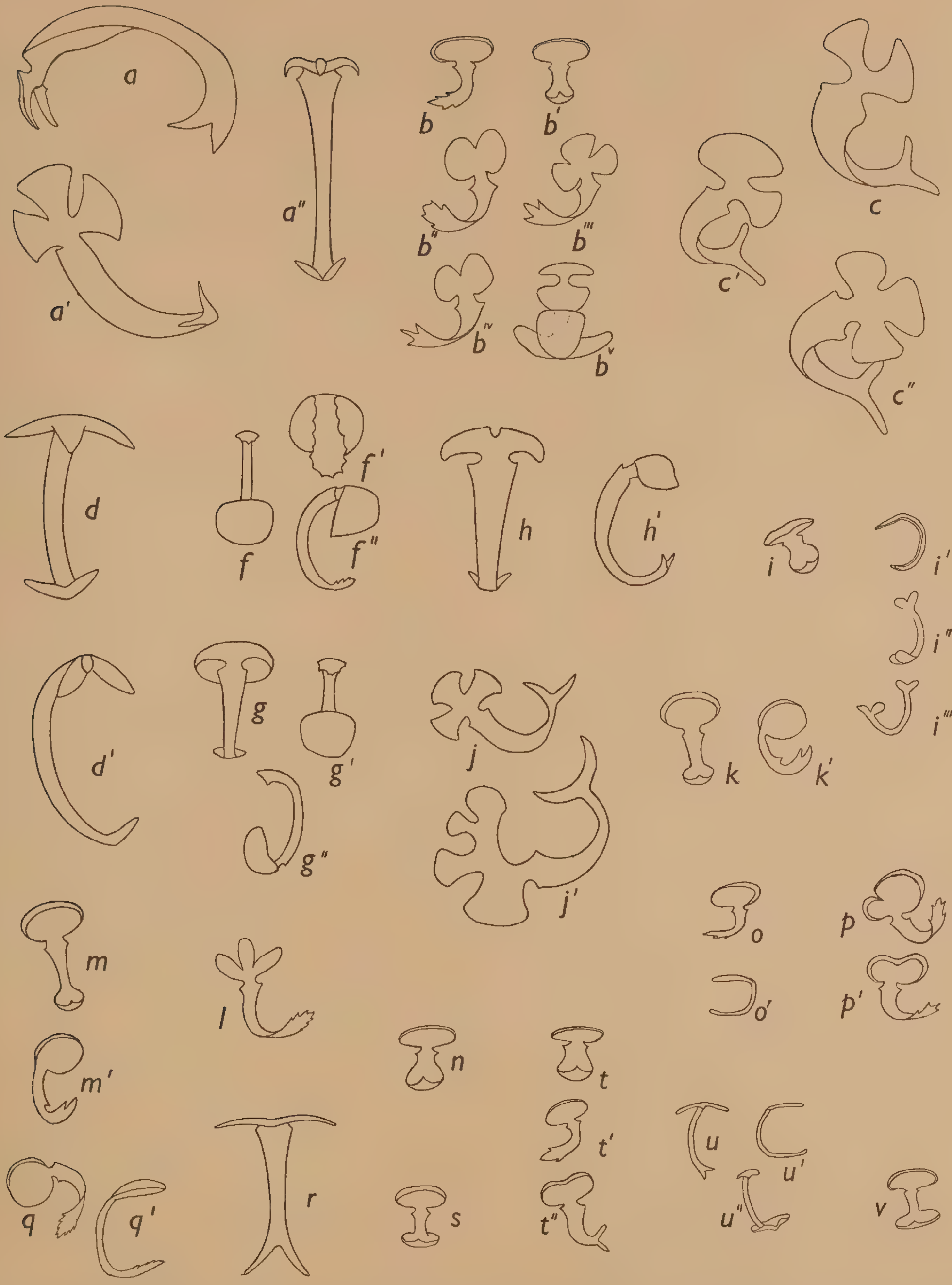

Fig. 24. *Iophon proximum* (Ridley), showing variation in size and shape of bipocilla. *a*, *I. chelifer ostia-magna*, Wilson (type); *b*, *I. chelifer*, Ridley and Dendy (co-type: B.M. 87. 5. 2. 157), *b* and *b′* are occasionally met, but b''–b^{v} represent the normal; *c*, *I. chelifer*, Ridley and Dendy (type); *d*, *I. chelifer*, Ridley and Dendy (Lambe's specimen); *f*, *I. indentatus*, Wilson (type); *g*, *I. lamella indivisus*, Wilson (type); *h*, *I. lamella*, Wilson (type); *i*, *I. pattersoni* (Bowerbank), Ridley and Dendy, *i* is the normal spicule, *i′* is a side view of the same, and *i″*–*i‴* are rarely met with; *j*, *I. chelifer*, Ridley and Dendy (Thiele's specimen); *k*, *D 255*; *l*, *D 256*; *m*, *D 251*; *n*, *D 739*; *o*, *D 740*; *p*, *D 257*; *q*, *D 254*, *D 258*; *r*, *D 431*; *s*, *D 252*; *t*, *D 837*; *u*, *D 430*; *v*, *Alebion proximum*, Ridley (type). All figures × 1800. Figs. *a*, *f*, *g*, *h* after Wilson; fig. *d* after Lambe; fig. *j* after Thiele.

echinating acanthostyli, persistently overlooked by previous authors, may occur (cf. Table, p. 297); (2) the variation in the occurrence and distribution of the anisochelae and bipocilla.

Distribution. Kerguelen; Cape of Good Hope; Tristan da Cunha; South America (Patagonia and Chile); Galapagos Islands; Canada (Pacific and Atlantic coasts).

Section *TEDANIEAE*

Genus Tedania, Gray

(For further notes on the Antarctic species of this genus see p. 342.)

Tedania tenuicapitata, Ridley (Fig. 25 *f*).

T. tenuicapitata, Ridley, 1881, p. 124, pl. xi, fig. 1.

Occurrence. St. WS 73: Falkland Islands, 121 m.; St. WS 76: Falkland Islands, 205–207 m.; St. WS 79: Falkland Islands, 131–132 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 88: Falkland Islands, 96–127 m.; St. WS 99: Falkland Islands, 251–225 m.; St. WS 239: Falkland Islands, 196–193 m.; St. WS 243: Falkland Islands, 144–141 m.; St. WS 246: Falkland Islands, 267–208 m.; St. WS 248: Falkland Islands, 210–242 m.; St. WS 250: Falkland Islands, 251–313 m.

Remarks. The holotype of *T. tenuicapitata*, Ridley is a small sub-pyramidal sponge, from Chile, probably incomplete, and its external characters are thus somewhat obscure. Its surface is even, minutely punctate, with several oscules, 2 mm. in diameter, on the upper margin. The spicules are: styli 0·38 by 0·013 mm., tornota 0·28 by 0·006 mm., and onychaeta 0·08–0·105 mm. and 0·32 mm. respectively. The several specimens assigned to this species by Ridley and Dendy (1887) vary from small and irregularly massive to flabellate, and form in themselves a well-graded series of transitions from the holotype to the large flabellate specimen illustrated by these authors (*loc. cit.*, pl. xi, fig. 5). The surface may be almost smooth or thrown into meandrine folds, to an extent far greater than suggested by Ridley and Dendy's illustration; and there are all stages between these two extremes. Thus, in one specimen the surface is smooth and even, but beneath the dermis, and visible through it, the underlying tissues have a meandrine formation such as is seen in *Artemisina dianae*, Topsent (1908, pl. iii, fig. 4). In extreme cases, the surface is folded like that of *Tedania oxeata*, Topsent (1917, pl. iv, fig. 14). The spicules in the Challenger specimens measure: styli 0·35–0·49 by 0·007–0·014 mm., tornota 0·28–0·3 by 0·004–0·006 mm., and onychaeta 0·07–0·28 mm., with no apparent division into groups of different sizes.

The present specimens vary in form and appearance to a slightly greater extent than the Challenger specimens, but are still massive to flabellate, with all intermediate forms between these two, and the surface is even, with the underlying tissues thrown into meandrine folds of varying size, or itself thrown into coarse and conspicuous meandrine folds. The spicules measure: styli 0·35–0·49 by 0·01–0·018 mm., tornota 0·18–0·39 by 0·004–0·011 mm., onychaeta, very variable, not always clearly differentiated into groups of different sizes, but on the whole they may be represented by the measurements 0·07–0·18 mm. and 0·28–0·43 mm.

Distribution. Chile.

Tedania massa, Ridley and Dendy (Fig. 25).

T. massa, Ridley and Dendy, 1886, p. 335; *id.*, *loc. cit.*, 1886, p. 53, pl. xi, fig. 4, pl. xxiii, fig. 2; *Paratedania tarantula*, Burton, 1929, p. 441. (For further synonymy see Burton, *loc. cit.*)

Occurrence. St. 42: South Georgia, 120–204 m.; St. 148: South Georgia, 132–148 m.; St. 152: South Georgia, 245 m.; St. 156: South Georgia, 200–236 m.; St. 158: South Georgia, 401–411 m.; St. 159: South Georgia, 160 m.; St. 160: Shag Rocks, 177 m.; St. 175: South Shetlands, 200 m.; St. 180: Palmer Archipelago, 160–330 m.; St. 181: Palmer Archipelago, 160–335 m.; St. WS 80: Falkland Islands, 152–156 m.; St. WS 81: Falkland Islands, 81–82 m.; St. WS 82: Falkland Islands, 140–144 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 87: Falkland Islands, 96–127 m.; St. WS 88: Falkland Islands, 96–127 m.; St. WS 93: Falkland Islands, 133–130 m.; St. WS 109: Falkland Islands, 145 m.; St. WS 216: Falkland Islands, 219–133 m.; St. WS 225: Falkland Islands, 161–162 m.; St. WS 231: Falkland Islands, 167–159 m.; St. WS 243: Falkland Islands, 144–141 m.; St. WS 244: Falkland Islands, 253–247 m.; St. WS 246: Falkland Islands, 267–208 m.; St. WS 248: Falkland Islands, 210–242 m.; St. WS 250: Falkland Islands, 251–313 m.

REMARKS. Topsent (1917, p. 59), in recording *Tedania charcoti* for the third time, included under this name four specimens having the same spiculation as the holotype of the species but possessing a peculiar external form combined with a chitinoid ectosome and a dermal tangential reticulation of styli instead of the brushes of tornota set at right angles to the surface. Later, I established the synonymy of these specimens with *Oceanapia tarantula* (Kirkpatrick) and removed the species to *Paratedania*. More specimens have come to hand in the present collection, and in the light of these it is clear that Topsent's action in treating this form as a simple variety of *T. charcoti* was nearer the truth than I had thought. In one jar, for example, there are five specimens. The largest is sub-spherical, about 11 cm. in greatest diameter, and differs in no obvious respect from the rounded specimens of *T. charcoti* described by Topsent (1913, p. 630, pl. v, figs. 3, 7). The same may be said of the smallest. A third specimen (Fig. 25 *a*) is fixed to a fragment of shell, and around the base of the sponge runs a narrow belt of chitinoid ectosome, the rest of the sponge being no different apparently from the first and second specimens. This chitinoid substance is also secreted around a portion of the shell. In a fourth specimen the chitinoid belt is wider, and just above it is an ill-defined, discontinuous pore area (Fig. 25 *b*). The upper part of the sponge, not covered with chitinoid ectosome, is again indistinguishable from the spherical form of *T. charcoti*. In the fifth (Fig. 25 *c*) specimen, the chitinoid covering is more extensive. The only differences from *T. charcoti* observed in these specimens, apart from the chitinoid ectosome, are (1) that the ends of the tornata tend to be more irregular and occasionally slightly spined; (2) the oscules tend to become papillate as the chitinoid ectosome increases; (3) beneath this special ectosome the brushes of tornota are lost and the dermal skeleton is composed of a tangential reticulation of styli (which may sometimes be modified to strongyla); (4) some, at least, of the pores become grouped into a meridional pore area; (5) the onychaeta are more liable to bear a swelling near one end (= tylorhaphides of Dendy). Typical specimens of *Paratedania tarantula* merely show an extreme form of this chitinoid development (Fig. 25 *d*, *e*). Despite the great difference between forms such as those shown in Figs. 25 *a*, *b* and 25 *d*, *e*, there is every reason to suppose that the one may develop from the other and that they are conspecific. Further, it is almost certain that the tangential skeleton of styli, the irregularity of the tornota, etc., are correlated with the development of the chitinoid ectosome and may possibly be induced by it. What gives rise to this ectosome is, however, still a mystery; but it is interesting to note that in some of the more typical individuals of *T. massa* irregularly rounded patches of such an ectosome occasionally occur and that their presence is always accompanied by some derangement of the outer layers of the skeleton, although a tangential layer of styli may not have been formed. This cuticle is so con-

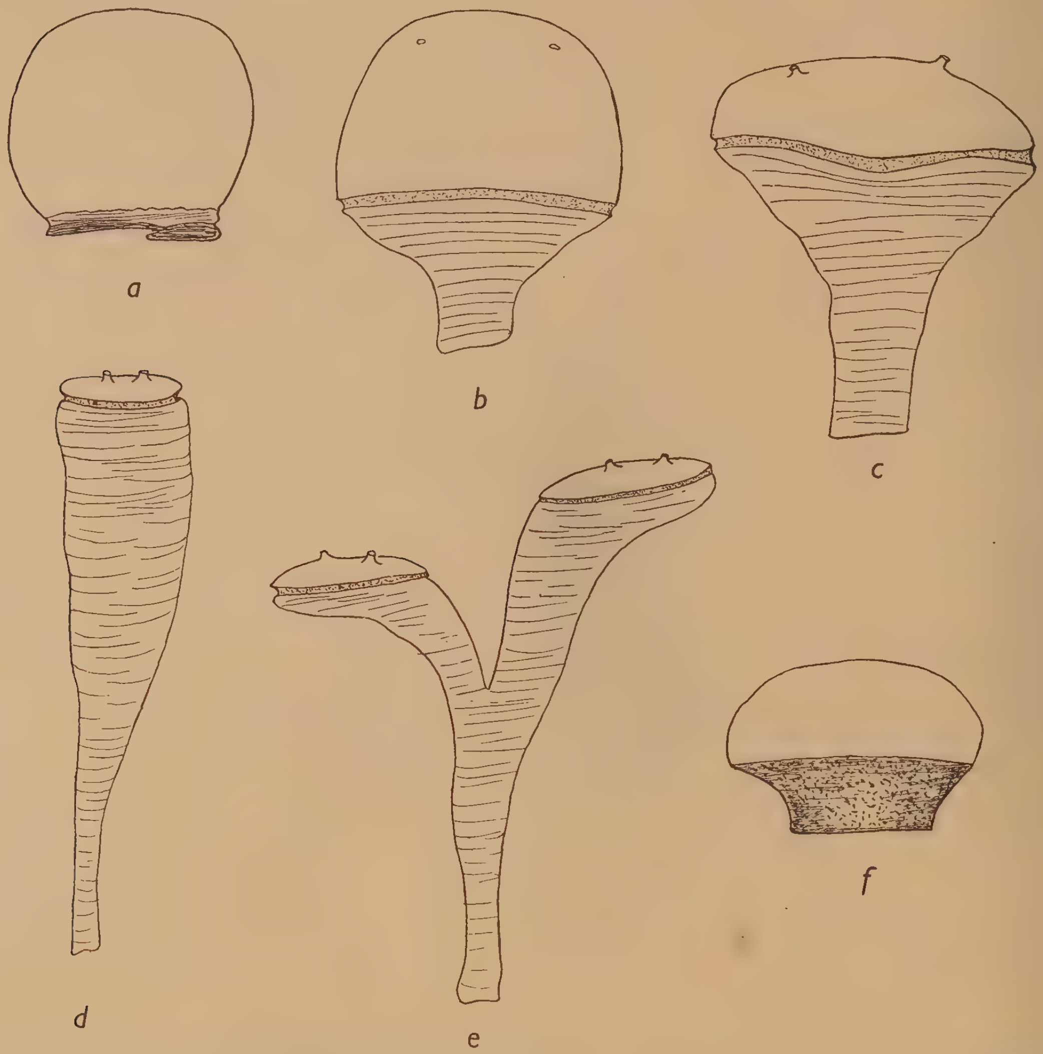

Fig. 25. *a–e*, *Tedania massa*, Ridley and Dendy, showing some of the variations in external form; *f*, *Tedania tenuicapitata*, Ridley, showing similarity of form due to the growth of an encrusting *Haliclona* around the basal half.

spicuous in several specimens that it is difficult to understand why Ridley and Dendy should have failed to mention it.

(An interesting case is shown in Fig. 19*f* where the base of a specimen of *T. tenuicapitata* is covered with an encrusting *Haliclona* sp. and the sponge has the superficial appearance of certain specimens of *T. massa*.)

Tedania vanhöffeni, Hentschel, has so much in common with certain specimens of *Paratedania tarantula* that there can be little doubt as to their identity, but re-examination of the type is necessary to establish this beyond doubt. Further, since the spiculations of *Tedania vanhöffeni* and *T. actiniiformis* are so similar it is probable that the latter may also be included eventually in the same species.

Paratedania tarantula (Kirkpatrick), originally described from Victoria Land, has the following well-marked characteristics: Form carrot-shaped, with most of the surface covered by a thick, light brown cuticle and having a well-marked, equatorial pore area immediately above the upper limits of the cuticle; spicules all of large size. According to the limits of the species established by me (1929, p. 441), which further research has not caused me to modify, the dimensions of the spicules are: styli 0·437–0·504 by 0·018–0·04 mm., tornota 0·344–0·504 by 0·007–0·012 mm., onychaeta of two sorts 0·064–0·162 and 0·4–0·76 mm. These measurements are, on the whole, greater than those of any other species hitherto described from the Antarctic or adjacent localities, except *Tedania massa*, Ridley and Dendy. Further, in eight specimens from the present collection, typical in all other respects, the sizes of the spicules are: styli 0·63–0·78 by 0·028–0·04 mm., tornota 0·32–0·35 by 0·007–0·011 mm., and onychaeta 0·07–0·28 and 0·6–0·7 respectively. The species seemed therefore to be characterized by the large size of its spicules and by the peculiarities of external form.

There are, however, several specimens which differ somewhat in external form but which would necessarily be included in the species. Thus, in six specimens from South Georgia, the form varies from carrot-shaped to massive and sub-spherical, with the cuticle restricted to the base of the sponge (cf. also p. 304, Fig. 25). In these, the dimensions, and other characters, of the spicules conform to the measurements given above as typical of the species. On the other hand, there are from the Falkland Islands eleven specimens, varying in form from carrot-shaped to massive and sub-spherical, with the cuticle restricted to the base of the sponge, in which the spicules have the following dimensions: styli 0·46–0·59 by 0·01–0·017 mm., tornota, 0·35 by 0·009 mm., and onychaeta 0·07–0·19 and 0·4–0·6 mm. respectively. Thus, the styli here are noticeably more slender than in those recorded above.

(It may be noted here, that whereas most of the Falkland Islands specimens are atypical in form, the onychaeta and tornota show the same characteristics, and the styli the same tendency to modification to strongyla, though to a lesser degree, as the Antarctic specimens.)

Following on this are three specimens from the Falkland Islands having the skeleton typical of *Paratedania tarantula*, but having a more atypical shape than the preceding specimens. The smallest is spherical, 10 cm. in diameter, and the largest sub-pyramidal and 20 cm. high. None is complete, the base being absent or damaged in each case, but in only one is there any sign of a cuticle, and in that it is restricted to a small patch on one side of the sponge.

The next batch of three, also from the Falklands, have a similar form, but more irregular, and they are larger. The spiculation again is typical of *P. tarantula*. Here, however, there is no sign of a cuticle; but the specimens contain embryos, and these are identical with the embryos found in the other groups of individuals referred to above as belonging to this species. There can therefore be no doubt, on embryological evidence as well as on spicular characters, that the carrot-shaped specimens of *P. tarantula*, the massive specimens with a restricted cuticle, and the large spherical or pyramidal specimens without cuticle are conspecific.

Another specimen, also from Falkland Islands, is unattached and discoid (cf. Fig. 56 *a*), but has the same spiculation and embryology as the other specimens of *P. tarantula*.

Turning now to *Tedania massa*, Ridley and Dendy, with which species *Paratedania tarantula* is most closely allied in spiculation, I find that the types of this species are as follows: holotype and first co-type, large, massive or sub-pyramidal sponges, with extensive cuticle-covered areas at the base, resembling Fig. 25 *b* in general appearance but much larger in size; massive and without cuticle; small and encrusting (on the back of a crab), without cuticle[1]; and large and thinly flabellate, again without cuticle.[2] Moreover, the embryos of *Tedania massa* are identical with those of *Paratedania tarantula*, so that the species must be considered synonymous.

Finally, a group of a dozen specimens, also from the Falklands, belong here but vary in form from massive, spherical and flabellate (all fixed ?) to discoid and unattached, but in none of them can any trace of a cuticle be found.

DISTRIBUTION. South America; Victoria Land; Wilhelm Land; Graham Land.

Tedania spinata (Ridley).

Trachytedania spinata, Ridley, 1881, p. 122, pl. x, fig. 10.

Occurrence. St. 51: Falkland Islands, 105–115 m.; St. 222: Cape Horn, 70–75 m.; St. WS 72: Falkland Islands, 79 m.; St. WS 75: Falkland Islands, 72 m.; St. WS 76: Falkland Islands, 205–207 m.; St. WS 77: Falkland Islands, 110–113 m.; St. WS 79: Falkland Islands, 131–132 m.; St. WS 80: Falkland Islands, 152–156 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 88: Falkland Islands, 96–127 m.; St. WS 91: Falkland Islands, 191–205 m.; St. WS 95: Falkland Islands, 108–109 m.; St. WS 108: Falkland Islands, 118–120 m.; St. WS 109: Falkland Islands, 145 m.; St. WS 210: Falkland Islands, 161 m.; St. WS 222: Falkland Islands, 100–106 m.; St. WS 225: Falkland Islands, 162–161 m.; St. WS 239: Falkland Islands, 196–193 m.; St. WS 243: Falkland Islands, 144–141 m.; St. WS 249: Falkland Islands, 166 m.

REMARKS. The holotype of *Trachytedania spinata*, Ridley, forms a thin crust on the valves of a *Pecten*. Its spiculation consists of smooth or basally spined styli 0·16–0·19 by 0·006 mm., tornota 0·18 by 0·004 mm., and onychaeta up to 0·15 mm. There are, in the present collection, a number of specimens which appear to belong to this species.

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[1] Specimen from St. 163 D (i.e. Australia). The station reference is queried in the original label.

[2] The "encrusting" sponge of Ridley and Dendy.

In these the spicules are smooth styli, with occasional spines near the base, 0·21–0·28 by 0·005–0·011 mm., tornota 0·18–0·21 by 0·004–0·007 mm., and onychaeta varying in length from 0·052 to 0·21 mm., not divided into groups of varying size. The specimens here assigned to *Tedania spinata* (Ridley) vary in form from sub-spherical (rarely), irregularly massive (rarely), branched, with stout cylindrical branches, to flabellate (the typical form) or discoid and unattached. The surface is typically smooth, even, punctured by commensal Amphipods and the dermis is typically tough and readily separable from the underlying tissues. Oscules, usually of small size, may be found scattered generally over the surface or, in flabellate and discoid forms, around the margins.

The styli are, for the most part, smooth, but there is an occasional tendency to a slight subtylostylote swelling to the base. In addition, spines may occur. The occurrence of the spines is, however, not only rare but very sporadic. For example, in a single section all the styli will be found to be smooth except for a small group situated at one point. Or, again, the spicules may be smooth with perhaps two or three basally spined forms found at rare intervals. Turning now to the holotype, the significance of this spining can be readily appreciated. In sections taken at right angles to the substratum it is found that the styli at the bases of the vertical columns are the most conspicuously spined and those towards the surface are hardly spined at all. Moreover, small acanthostyli, remarkably like those, to be described later, found in the embryos of the specimens here assigned to *T. spinata*, are very occasionally to be found associated with the normal basally spined styli set on the substratum. It seems probable therefore that the holotype of this species represents nothing more than the immediate post-fixation form of the species; that there is retained in the adult a tendency to the formation of spines on the styli, and that this tendency, although almost wholly suppressed in the adult, is yet found in occasional spicules.

DISTRIBUTION. Chile.

Tedania charcoti, Topsent.

T. charcoti, Topsent, 1908, p. 30, pl. i, fig. 3, pl. iii, fig. 3, pl. v, fig. 6; 1913, p. 630, pl. v, figs. 3–7; *nec* Topsent, 1917.

Occurrence. St. 39: South Georgia, 179–235 m.; St. 140: South Georgia, 122–136 m.; St. 145: South Georgia, 26–35 m.; St. 146: South Georgia, 728 m.; St. 148: South Georgia, 132–148 m.; St. 152: South Georgia, 245 m.; St. 158: South Georgia, 401–411 m.; St. 160: Shag Rocks, 177 m.; St. WS 27: South Georgia, 106–109 m.; St. WS 42: South Georgia, 198 m.

The nineteen specimens range from a few centimetres in longest diameter to nearly 20 cm. From the structure of the skeleton it is possible to divide this group into two smaller groups; the first, of five specimens, is characterized by a dense skeleton and thick spicules (styli 0·36–0·49 by 0·02–0·031 mm.), with the dermal skeleton composed of a very dense palisade of stout tornota (measuring 0·32–0·39 by 0·014–0·021 mm.). The second group, of eleven specimens, is characterized by a loose skeleton composed of few spicules, mainly slender (styli 0·35–0·52 by 0·011–0·021 mm.), with a diffuse dermal skeleton of slender tornota (measuring 0·24–0·34 by 0·007–0·009 mm.). There are in addition three specimens with skeletons somewhat intermediate in character between those of these two groups. In external form the specimens of each group show the same variations; from massive with digitate or flabellate processes, to massive, with the surface raised into low rounded prominences, and, in rare cases, sub-clathrate. Further, all the five specimens of the first group are from St. WS 27 (South Georgia, 106·9 m. depth) and four of the second group are from the same locality. The remaining specimens of group 2 are also from South Georgia, from depths varying between 132 and 411 m. The similarity in external form between the members of the two groups, the presence of intermediates as regards skeleton structure, and the similarity between the two groups in spiculation, except for size of spicules and numbers present, suggest that there is no taxonomic significance in this sub-division. Similarly, since all the specimens from the first, and a third of the specimens from the second group are from the same station, an ecological significance is hardly a possibility. It is, however, remarkable that seven specimens of group 2, out of a total of eleven, contain embryos while none of the specimens of group 1 has any. Possibly the looseness of the skeleton may have something to do with the development of the embryos, and we may therefore accept all nineteen as conspecific.

Several of the specimens of this group are almost identical with the co-type of *Tedania charcoti*, Topsent (1908, pl. iii, fig. 3). One or two of them approximate fairly closely to the holotype (*id.*, *loc. cit.*, pl. i, fig. 3), and there are several which differ slightly from both. There can, however, be little doubt that all belong to *T. charcoti*. Here, however, another point arises: Topsent (1908) records only two sorts of onychaeta in his specimens, but in the present specimens exceptions are found to this. In the types of this species, these spicules measure 0·09–0·12 and 0·25–0·265 mm. long. In eleven of the present specimens three sizes of onychaeta were found, the smallest measuring from 0·05 to 0·105 mm., with an average of 0·08 mm., the largest, 0·24–0·32 mm., with an average of 0·29 mm. Intermediate sizes were found, admittedly rare, varying from 0·105 to 0·24 mm., with an average of 0·163 mm. In six specimens, no intermediates were found, but in two specimens four separate categories appeared to be present. Moreover, in some specimens the onychaeta were rare, in others commonly present, and in rare cases so abundant that they formed the bulk of the skeleton. It does not seem possible therefore to use the onychaeta for the determination of species.

DISTRIBUTION. Graham Land; Burdwood Bank.

Tedania murdochi, Topsent.

T. murdochi, Topsent, 1913, p. 629, pl. v, fig. 5.

Occurrence. St. 53: Falkland Islands, 0–2 m.

REMARKS. The typical form of *T. murdochi*, Topsent (1913, pl. v, fig. 5), is massive, with mammiform lobes bearing oscules at their summits. The surface is usually wrinkled, and in the present specimens has somewhat the appearance presented by the holotype of *T. charcoti*, Topsent (1913, pl. i, fig. 3). The colour is deeper than in the other Antarctic species, being a deep olive-green or greenish brown. The spicules of the holotype are: styli 0·235 by 0·008 mm., tornota 0·22 by 0·005 mm., and onychaeta, not differentiated into two groups, 0·04–0·175 mm. In the present specimens the sizes are: styli 0·21–0·22 by 0·007 mm., tornota 0·18–0·2 by 0·004–0·005 mm., and onychaeta 0·07–0·21 mm.

DISTRIBUTION. Falkland Islands.

Tedania oxeata, Topsent.

T. oxeata, Topsent, 1916, p. 169; 1917, p. 61, pl. iv, fig. 14, pl. vi, fig. 19; Burton, 1929, p. 441.

Occurrence. St. 170: Clarence Island, 342 m.

DISTRIBUTION. Graham and Victoria Lands.

Section *MYXILLEAE*

Genus **Myxilla**, Schmidt

Myxilla mollis, Ridley and Dendy (Plate LV, figs. 1–4).

Myxilla mollis, Ridley and Dendy, 1886, p. 471; *M. spongiosa*, *id.*, *loc. cit.*, p. 471; *M. mollis*, *id.*, 1887, p. 133, pl. xxvii, fig. 4; *M. spongiosa*, *id.*, *loc. cit.*, p. 134, pl. xxvii, fig. 3; Kirkpatrick, 1908, p. 28; Hentschel, 1914, p. 97, pl. vii, fig. 5; *M. magna*, Topsent, 1916, p. 168; *id.*, 1917, p. 56, pl. iii, fig. 4, pl. vi, fig. 9.

Occurrence. St. 42: South Georgia, 120–204 m.; St. 123: South Georgia, 230–250 m.; St. 159: South Georgia, 160 m.; St. 175: South Shetlands, 200 m.; St. 181: Palmer Archipelago, 160–335 m.; St. WS 27: South Georgia, 106–109 m.; St. WS 42: South Georgia, 198 m.; St. WS 76: Falkland Islands, 205–207 m.; St. WS 79: Falkland Islands, 131–132 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 88: Falkland Islands, 118 m.; St. WS 99: Falkland Islands, 251 m.; St. WS 225: Falkland Islands, 162–161 m.; St. WS 239: Falkland Islands, 196–193 m.; St. WS 244: Falkland Islands, 253–247 m.; St. WS 246: Falkland Islands, 267–208 m.; St. WS 247: Falkland Islands, 172 m.; St. WS 250: Falkland Islands, 251–313 m.; St. MS 71: South Georgia, 120–60 m.

DIAGNOSIS. Young sponge cylindrical or flabellate, with smooth, even surface; adult sponge massive, sub-spherical or massively flabellate with surface more or less conulose, or thrown into low, rounded tubercles; main skeleton, at all times, ranging from regularly isodictyal to sub-isodictyal with triangular meshes, often irregularly confused; dermal skeleton a tangential layer of tornota in young sponges, which is gradually lost with maturity, tornota being then arranged in dermal brushes or else almost absent from dermis; megascleres smooth, straight or curved styli or, occasionally, subtylostyli with long oval heads, with one or a few spines at base in young forms; microscleres ancorae spatuliferae and sigmata, both forms being very variable in size or even, occasionally, separated into two or more categories.

REMARKS. The species is represented by twenty-one specimens which show that the variations are of two kinds, due to (1) the fluctuating variations in size of spicule, arrangement of skeleton and external form, and (2) the changes which accompany maturity.

The variation in the external form is not considerable and the present specimens agree closely in this, and in the texture, with the holotype. The form ranges from irregularly massive to sub-spherical or flabellate. The surface may be minutely conulose or thrown into conspicuous rounded tubercles. The largest flabellate specimen measures 9 cm. high, by 9 cm. across, by 4 cm. thick. The largest sub-spherical specimen is 7 cm. in diameter. The smallest is sub-spherical and 1 cm. in diameter.

The skeleton varies between regularly isodictyal, with polyspicular primary fibres joined at intervals by horizontally arranged single spicules, and sub-isodictyal, with triangular meshes.

DISTRIBUTION. Graham Land; Wilhelm Land; Victoria Land; east coast of South America up to mouth of Rio de la Plata.

Myxilla australis (Topsent) (Plate LIV, fig. 6).

Dendoryx incrustans, var. *australis*, Topsent, 1901, p. 7; *id.*, 1901, p. 17, pl. iii, fig. 11; *Myxilla australis*, *id.*, 1917, p. 53, pl. vi, fig. 10.

Occurrence. St. 190: Palmer Archipelago, 93–130 m.; St. WS 27: South Georgia, 106–109 m.

DIAGNOSIS. Sponge encrusting or massive; surface smooth, uneven, minutely reticulate; oscules large, conspicuous, leading into deep cloacal cavities; pores scattered generally over surface; dermal membrane readily separable, translucent, showing large sub-dermal cavities beneath; colour, in spirit, white; main skeleton a sub-isodictyal reticulation of spined styli; dermal skeleton composed of numerous loose bundles of tornota, set at right angles to surface, with outer ends supporting a tangential reticulation of similar spicules; styli of main skeleton, sparingly spined throughout length, 0·44–0·6 by 0·015–0·018 mm.; tornota, usually in form of straight, slender styli, bearing scattered spines at each end, 0·27–0·35 by 0·008–0·01 mm.; tridentate isochelae of two sizes, larger 0·047–0·06 mm., and smaller 0·024 mm. long; sigmata 0·03–0·06 mm.

REMARKS. The present specimen appears to agree closely with the holotype of the species, except for the presence of the second type of chelae. Since these are small and not numerous, it is possible that Topsent overlooked them in his original examinations.

DISTRIBUTION. Graham Land.

Myxilla asigmata, Topsent.

M. spongiosa, var. *asigmata*, Topsent, 1901, p. 18; *Lissodendoryx spongiosa*, var. *asigmata*, *id.*, 1908, p. 26, pl. iii, fig. 1; *Myxilla spongiosa*, var. *asigmata*, *id.*, 1913, p. 625, pl. iii, fig. 3; Hentschel, 1914, p. 99.

Occurrence. St. 145: off South Georgia, 26–35 m.

REMARKS. Of the specimens hitherto recorded the majority have been encrusting or massive but spreading. That described by Topsent (1913) was, however, pyriform and slightly pedunculate. In all the surface is slightly conulose. The present specimen therefore appears to correspond fairly closely with that described by Topsent (*loc. cit.*), but is more complete and better preserved than any yet recorded. It is pyriform and pedunculate, 70 mm. high, and 60 mm. by 25 mm. across the top. Several small oscules are situated on the upper surface. The general surface of the sponge is even, glistening when removed from the alcohol, and very minutely conulose.

The dimensions of the spicules are the smallest on record. Those of the previously described specimens range as follows: styli 0·495–0·9 by 0·02–0·028 mm., tornota 0·285–0·4 by 0·007–0·01 mm., chelae 0·04–0·075 mm. Those of the present specimen are: styli 0·3 by 0·009 mm., tornota 0·18 by 0·006 mm., chelae 0·03–0·063 mm. The most noticeable feature of this variation in spicule size is that although the two categories of megascleres vary considerably in size, the chelae are almost constant. This holds true for most species of sponges, that while the microscleres may be almost constant in size, the megascleres may be subject to very large ranges of variation.

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land.

Myxilla chilensis, Thiele (Plate LIV, fig. 10).

M. chilensis, Thiele, 1905, p. 443, figs. 22, 62.

Occurrence. St. 58: Falkland Islands, 0–5 m.

REMARKS. The single example is growing in intimate association with an alga, the sponge tissues forming a thin coating on the branches of the alga. The skeleton is quite typical except that the acanthostyli are smaller than those of the holotype and are more tapering at the distal end, resembling more the acanthostyli of *Hymedesmia laevis*, Thiele (*loc. cit.*, pl. xxxi, fig. 69 *b*).

DISTRIBUTION. Chile.

Myxilla elongata, Topsent.

M. elongata, Topsent, 1916, p. 168; 1917, p. 54, pl. iv, fig. 3, pl. vi, fig. 11; Burton, 1929 p. 435.

Occurrence. St. 158: South Georgia, 401–411 m.; St. 160: Shag Rocks, 177 m.

REMARKS. The two specimens agree closely in all respects, the larger being irregularly lobose and white in colour, with smooth but even surface. Both differ from the type in size, the arrangement of the tornota, the more feeble spining of the tornota, and in the presence of echinating acanthostyli (see Burton, *loc. cit.*).

DISTRIBUTION. Graham Land; Victoria Land.

Myxilla basimucronata, sp.n. (Fig. 26).

Holotype. B.M. 28. 2. 15. 462.

Occurrence. St. 42: South Georgia, 120–204 m.; St. WS 27: South Georgia, 106–109 m.; St. WS 42: South Georgia, 198 m.

DIAGNOSIS. Sponge of small size, sub-ramose with cylindrical branches or forming dorso-ventrally flattened lobes; surface smooth, even; dermal membrane readily separable; sub-dermal cavities spacious; pores and oscules not apparent; colour, in spirit, pale brown; main skeleton a regular reticulation of smooth styli, 0·47 by 0·017 mm., slightly curved and bearing a basal mucron; dermal skeleton a tangential layer of tornota regularly crossing each other in all directions, supported by brushes of tornota planted directly on distal ends of ascending fibres of main skeleton; tornota inequi-ended, 0·25 by 0·008 mm., with ends slightly swollen and bearing a terminal mucron surrounded by numerous microspines; microscleres sigmata of two sizes, 0·042 and 0·025 mm. chord, and ancorae spatuliferae of two sizes, 0·042 and 0·021 mm. chord.

Remarks. The species is very closely related to *M. magna*, Topsent, and it is indeed possible that the two may eventually prove to be identical, but the present species differs from Topsent's species in external form, in the dimensions of its spicules and in the presence of a basal mucron on the styli.

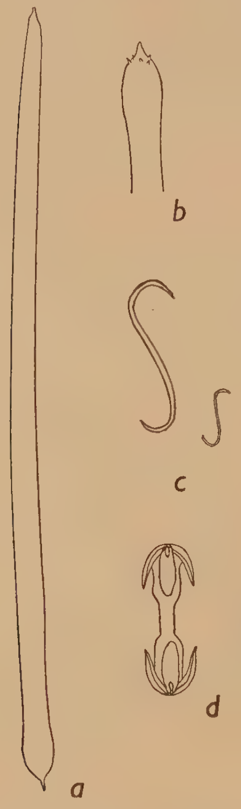

Fig. 26. *Myxilla basimucronata*, sp.n. *a*, style, × 240; *b*, end of typical tornote, × 500; *c*, sigmata, × 500; *d*, chelae, × 500.

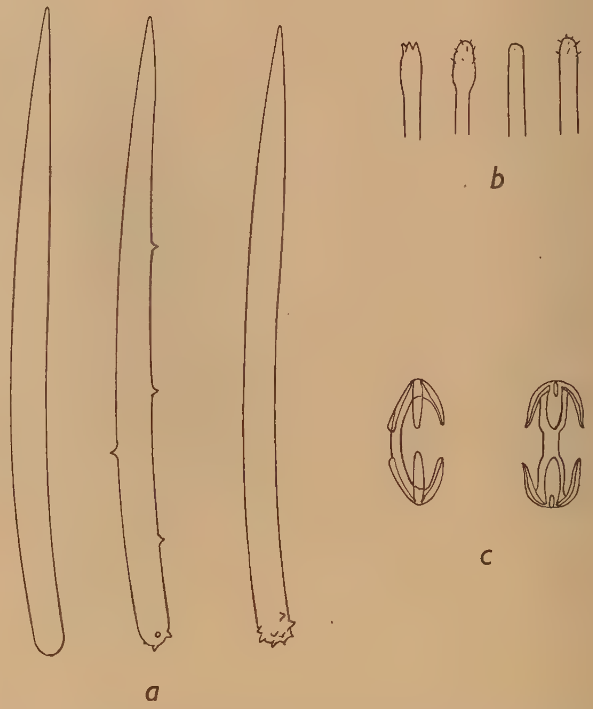

Fig. 27. *Myxilla verrucosa*, sp.n. *a*, styli, and modifications, × 300; *b*, tornota, showing variation in shape of ends, × 300; chelae, × 500.

Myxilla verrucosa, sp.n. (Fig. 27).

Holotype. B.M. 28. 2. 15. 828.

Occurrence. St. WS 243: north-east of Falkland Islands, 144–141 m.

Diagnosis. Sponge small, irregularly massive; surface uneven, verrucose; texture friable; oscules and pores not apparent; colour, in spirit, greenish grey; main skeleton a sub-isodictyal reticulation of styli (often modified to incipient acanthostyli); styli of main skeleton, often bearing a few spines at the base, 0·24 by 0·008–0·018 mm.; dermal tornota, straight, with ends strongylote to subtylote, often minutely spined, 0·16 by 0·007 mm.; chelae, 0·035 mm. chord.

REMARKS. The species may be distinguished from other Antarctic species of *Myxilla* by the absence of sigmata.

Genus **Ectyodoryx**, Lundbeck

Ectyodoryx paupertas, subsp. **nobile** (Ridley and Dendy).

Myxilla nobilis, Ridley and Dendy, 1886, p. 473; *M. nobilis*, var. *patagonica*, *id.*, *loc. cit.*, p. 473; *M. nobilis*, var. *bacillifera*, *id.*, *loc. cit.*, p. 473; *M. nobilis*, *id.*, 1887, p. 140, pl. xxvii, fig. 15, pl. xxx, fig. 2; *M. nobilis*, var. *patagonica*, *id.*, *loc. cit.*, p. 142, pl. xxvii, fig. 13; *M. nobilis*, var. *bacillifera*, *id.*, *loc. cit.*, p. 142, pl. xxvii, fig. 14; *Stylostichon nobile*, var. *patagonicum*, Topsent, 1913, p. 622; *Ectyodoryx nobilis*, Burton, 1929, p. 399.

Occurrence. St. 157: South Georgia, 970 m.; St. 158: South Georgia, 401–411 m.; St. 159: South Georgia, 160 m.; St. WS 79: Falkland Islands, 131–132 m.; St. WS 82: Falkland Islands, 140–144 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 86: Falkland Islands, 151–147 m.; St. WS 225: Falkland Islands, 162–161 m.; St. WS 239: Falkland Islands, 196–193 m.; St. WS 243: Falkland Islands, 144–141 m.; St. WS 247: Falkland Islands, 172 m.; St. WS 249: Falkland Islands, 166 m.

REMARKS. The five specimens in the collection show clearly that it is unnecessary to maintain the varieties *patagonica* and *bacillifera*. It is quite evident that the species is variable in so far as the characters of the spicules are concerned. The bases of the styli, for example, may be simply irregularly tuberculate, or may bear a few spines, or they may be crowded with numerous small spines. The tornota may be simply strongylote at each end, or the ends may be slightly inflated, and in both cases a few small spines may or may not be present. An important feature which Ridley and Dendy overlooked is the differentiation of the chelae into two categories, the larger being approximately twice the size of the smaller.

As has already been suggested by Ridley and Dendy (1887, p. 143) and Arnesen (1920, p. 23), I propose to regard *Myxilla nobilis* and *M. paupertas* as forms of one species, the former and its varieties constituting a subspecies distributed throughout the South Atlantic and the immediately adjacent waters, and the latter as a subspecies confined to the North Atlantic. The difference between these two subspecies consists almost entirely in the larger size of the spicules and the slightly more profuse spining in the styli of *Ectyodoryx paupertas*, subsp. *typica*, subsp.n. This subspecies includes, in addition to the forms mentioned by Topsent (1904, p. 168), *Anchinoë nobilis*, Arnesen (1920, p. 22).

DISTRIBUTION. Crozet Islands; Patagonia; off the mouth of the Rio de la Plata; Burdwood Bank.

Ectyodoryx antarctica (Hentschel).

Lissodendoryx antarctica, Hentschel, 1914, p. 102, pl. vii, fig. 9; Burton, 1929, p. 399.

Occurrence. St. 160: Shag Rocks, 177 m.

REMARKS. The present specimen agrees with Hentschel's holotype from the Antarctic in external form, in the shape of the acanthostyli and tornota, and, fairly closely, in the dimensions of the spicules. It differs in the presence of small, echinating acanthostyli, and in the somewhat broader shape of the chelae. The dimensions of its spicules are: large acanthostyli 0·195 by 0·012 mm., echinating acanthostyli 0·09 by 0·006 mm., tornota 0·18 by 0·004 mm., larger chelae 0·021 mm., smaller chelae 0·013 mm., sigmata 0·018–0·025 mm.

As regards the presence of the echinating acanthostyli, there is a specimen from McMurdo Sound, in the British Museum collection, which I had identified as a perfectly typical example of *L. antarctica*. On re-examination, however, this was found to have echinating acanthostyli also, but they were rather rare, and I had overlooked them in my first examination. Possibly therefore the holotype of the species may also possess echinating acanthostyles which were overlooked by Hentschel.

The dimensions of the spicules in the McMurdo Sound sponge are: large acanthostyli 0·24 by 0·004 mm., echinating acanthostyli 0·15 by 0·009 mm., tornota 0·189 by 0·006 mm., larger chelae 0·026 mm., smaller chelae 0·018 mm., sigmata 0·02–0·03 mm. This specimen thus approximates more closely to that described by Hentschel in the dimensions of its spicules.

Assuming that the species rightly belongs to *Ectyodoryx*, we may say that it has considerable resemblance to *Ectyodoryx* (*Myxilla*) *compressa* (Ridley and Dendy) and, to a lesser extent, to *Ectyomyxilla kerguelensis*, Hentschel.

DISTRIBUTION. Wilhelm Land; Victoria Land.

Ectyodoryx frondosa (Ridley and Dendy), var. anacantha, Hentschel.

E. frondosa, var. *anacantha*, Hentschel, 1914, p. 107, pl. iv, fig. 11, pl. vii, fig. 12.

Occurrence. St. 190: Palmer Archipelago, 93–130 m.

DISTRIBUTION. Wilhelm Land.

Ectyodoryx ramilobosa (Topsent).

Dendoryx ramilobosa, Topsent, 1916, p. 167; *id.*, 1917, p. 47, pl. iii, fig. 3, pl. vi, fig. 6; *Ectyodoryx ramilobosa*, Burton, 1929, p. 399.

Occurrence. St. 159: South Georgia, 160 m.

REMARKS. It will probably be found, when a comprehensive survey of the various species of Myxilleae is made, that this species differs generically from the other species of *Ectyodoryx*. The columns of smooth, basally spined styli, echinated abundantly by similar but smaller styli, probably constitute a feature worthy of generic distinction.

Until it is possible to know more concerning the variations in skeletal structure found in this group, however, it would be unwise to insist on such distinction.

DISTRIBUTION. Victoria Land; Graham Land.

Genus Anchinoë, Gray.

Anchinoë latrunculioides (Ridley and Dendy).

(For synonymy see Burton, 1929, p. 439.)

Occurrence. St. 156: South Georgia, 200–236 m.; St. 159: South Georgia, 160 m.; St. 160: Shag Rocks, 177 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 243: Falkland Islands, 144–141 m.

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land; east coast of South America, up to mouth of Rio de la Plata; South Africa.

Anchinoë areolata (Thiele).

Hymedesmia areolata, Thiele, 1905, p. 452, figs. 23, 68; Kirkpatrick, 1908, p. 24, pl. xxii, fig. 3; Burton, 1931, p. 519, pl. i, fig. 1, text-fig. 3.

Occurrence. St. 152: South Georgia, 245 m.; St. 157: South Georgia, 970 m.; St. 160: Shag Rocks, 177 m.

DISTRIBUTION. Calbuco; Victoria Land.

Anchinoë leptochela (Hentschel) (Plate LIV, fig. 11).

Hymedesmia leptochela, Hentschel, 1914, p. 115, pl. viii, fig. 2.

Occurrence. St. 42: South Georgia, 120–204 m.; St. 159: South Georgia, 160 m.

REMARKS. It is a natural suspicion that many of the species of *Hymedesmia* may eventually prove to be the encrusting, possibly immediate post-fixation stages, of other species of Myxilleae. This, at all events, appears to be the case with *H. leptochela*, Hentschel. The holotype formed a thin encrustation on foreign bodies (Fremdkörper), and had a smooth surface with a low papillate oscule. The skeleton showed the usual *Hymedesmia* structure. The present specimens range from encrusting to massive, always growing on fragments of rock, often incorporating much foreign matter in their substance, and bear a number of papillate oscules. The spicules are almost identical with those of the holotype, but are arranged as in *Anchinoë*.

There is no obvious reason why the skeleton in the immediate post-fixation stage of an *Anchinoë* should not consist of acanthostyli set at right angles to the substratum, with their bases planted thereon, nor why, as growth proceeds, the acanthostyli should not be rearranged to form the ascending fibres, cored by tornota and echinated by acanthostyli, of a typical *Anchinoë*.

DISTRIBUTION. Wilhelm Land.

Genus **Stelodoryx**, Topsent.

Genotype. S. procera, Topsent, 1904, p. 174.

Remarks. The original diagnosis reserves this genus for stipitate "Dendoricinae" with skeleton composed of longitudinal branching fibres, continuous with the axial skeleton of the pedicel, connected at intervals by single spicules placed at right angles to the main fibres. Whether the disposition of the fibres in the genotype constitutes a sound generic character is an open question. Perhaps the more distinctive feature of its spiculation is, however, the presence of polydentate isochelae, and while it is doubtful whether this constitutes a sufficiently good character for generic distinction, a distinction based on this character alone is as good as that at present maintained between *Myxilla* and *Lissodendoryx*, genera closely allied to *Stelodoryx*. For the present, therefore, I propose to adopt the genus *Stelodoryx* as a convenient arbitrary division of those Myxilleae in which the distinctive feature is the presence of polydentate isochelae.

Other species which fall naturally into *Stelodoryx*, as now understood, are *Dendoryx dentata*, Topsent (*loc. cit.*, p. 172), *Myxilla diversiancorata*, Lundbeck (1905, p. 150), *M. pluridentata*, Lundbeck (*loc. cit.*, p. 154), and *S. discoveryi*, sp.n.

Stelodoryx pluridentata (Lundbeck).

Myxilla pluridentata, Lundbeck, 1905, p. 150, pl. v, fig. 3, pl. xv, fig. 2 *a–i*.

Occurrence. St. WS 243: Falkland Islands, 144–141 m.

Remarks. Except that the spicules are slightly smaller it is impossible to find any difference between the present specimen and the type of *Myxilla pluridentata*. The chelae, for example, seldom exceed 0·065 mm. chord, as against 0·071–0·097 mm., the tornota vary from 0·24 to 0·28 mm., as against 0·226–0·32 mm., although the ends show the same variability in each case, and the styli, although much the same size, are sometimes slightly tylote in the present specimen. Externally, the two specimens agree closely except that the type is much smaller, the present specimen measuring 4 cm. by 4 cm. by 5 cm. high.

The specimen from Falkland Islands may be conspecific with the Arctic specimen (i.e. the type), or the two may represent convergent species which are indistinguishable. At all events, the wide geographical separation is a point of interest.

Distribution. Iceland.

Stelodoryx discoveryi, sp.n. (Fig. 28).

Holotype. B.M. 28. 2. 15. 426.

Occurrence. St. WS 88: Falkland Islands, 96–127 m.; St. WS 90: Falkland Islands, 82–81 m.

Diagnosis. Sponge irregularly massive; surface even and smooth to the naked eye, very minutely hispid when viewed with a hand lens; oscules 1–2 mm. in diameter, arranged in linear series on ridge-like portions of surface, or at apices of lobular outgrowths; pores apparently arranged generally over surface; texture compressible but elastic; colour, in spirit, very dark brown; main skeleton an isodictyal reticulation of smooth styli forming multispicular primary fibres, about six spicules thick, running vertically to surface, connected at intervals by irregularly arranged single spicules; dermal skeleton composed of irregular brushes of tornota arranged more or less at right angles to surface; megascleres smooth, often slightly curved, styli, 0·225 by 0·006 mm., and straight tornota, with ends mucronate, strongylote or truncate and sparingly spined, occasionally asymmetrical, 0·165 by 0·005 mm.; microscleres, polydentate isochelae, with usually five teeth, 0·035–0·045 mm. long.

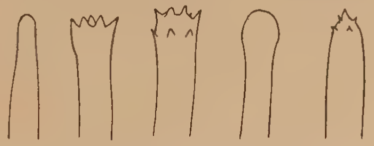

Fig. 28. *Stelodoryx discovereyi*, sp.n. Examples of variation in ends of tornota, × 1000.

Remarks. The present species differs from the genotype in the absence of a pedicel and the smaller size of the styli, from *S. dentata* in having smooth styli, instead of acanthostyli, from *S. diversiancorata* in having only one sort of isochela, and from *S. pluridentata*, which it most nearly resembles, in the smaller size of the isochelae.

Genus **Kirkpatrickia**, Topsent.

Kirkpatrickia variolosa (Kirkpatrick).

Tedania variolosa, Kirkpatrick, 1907, p. 279; *id.*, 1908, p. 32, pl. xxi, fig. 1, pl. xxv, fig. 1; *Kirkpatrickia variolosa*, Topsent, 1912, p. 3.

Occurrence. St. 149: South Georgia, 200–234 m.; St. 175: South Shetlands, 200 m.; St. WS 27: South Georgia, 106–109 m.

Remarks. The specimens in life were coloured bright crimson or deep magenta red.

Distribution. Victoria Land.

Kirkpatrickia coulmani (Kirkpatrick) (Plate LV, fig. 5).

Tedania coulmani, Kirkpatrick, 1907, p. 280; *id.*, 1908, p. 33, pl. xxi, fig. 2, pl. xxv, fig. 2; *Kirkpatrickia coulmani*, Topsent, 1912, p. 3.

Occurrence. St. 42: South Georgia, 120–204 m.

Remarks. The present specimen agrees closely with the holotype except that the styles are entirely smooth.

Distribution. Victoria Land.

Genus **Acheliderma**, Topsent.

The genus belongs obviously to the Myxilleae. Owing to Hallmann's (1920, p. 768) diagnosis of *Allocia*, there appears, at first sight, to be some similarity between this genus and *Acheliderma*. This is due to his having suggested the possibility of the occurrence of toxa in forms, as yet undescribed, allied to the genotype of *Allocia*, *Spanioplon cheliferum*, Hentschel. It was probably the inclusion of the phrase "perhaps sometimes accompanied by toxa," in his diagnosis, that caused Hallmann to overlook the obvious affinity of *S. cheliferum* with *Ectyodoryx*, which Hentschel (1911, p. 363) himself had suggested.

Acheliderma topsenti, sp.n. (Plate LIV, figs. 7–9).

Holotype. B.M. 28. 2. 15. 393.

Occurrence. St. 160: near Shag Rocks, 177 m.

DIAGNOSIS. Sponge small, flabello-digitate; surface uneven, hispid; oscules and pores not apparent; texture tough; colour, in spirit, yellow; skeleton a sub-isodictyal reticulation of styli, with main fibres semi-plumose, echinated by acanthostyles; a confused layer of tornota occurs in dermis and tornota are found sparingly associated with main skeleton; main skeleton contains a small amount of spongin; microscleres, isochelae palmatae and toxa; styli of main skeleton, long, smooth, but bearing a few feeble spines at base, slightly curved, 0·42 by 0·009 mm.; acanthostyli, slightly curved, regularly and sparingly spined throughout length, 0·15 by 0·007 mm.; tornota, smooth, straight, truncate, bearing a crown of a few spines at each end, 0·225 by 0·003 mm.; isochelae palmatae, 0·021 mm. long; toxa long, smooth, ends not spined but ending in a sharp point, 0·06–0·48 by 0·007 mm.

REMARKS. The present species differs from the genotype, *A. lemniscata*, Topsent, from the North Atlantic, in the longer toxa and in possessing isochelae instead of raphides. Otherwise the two species agree very closely in spiculation.

Genus **Inflatella**, Schmidt

Inflatella belli (Kirkpatrick).

(For synonymy see Burton, 1929, p. 439.)

Occurrence. St. WS 83: Falkland Islands, 137–129 m.; St. WS 248: Falkland Islands, 210–242 m.

DISTRIBUTION. Victoria Land; Wilhelm Land; New Zealand.

Section *PLOCAMIEAE*

Genus **Plocamia**, Schmidt

Plocamia gaussiana, Hentschel.

Plocamia gaussiana, Hentschel, 1914, p. 120, pl. viii, fig. 5; Burton, 1929, p. 435.

Occurrence. St. 42: South Georgia, 120–204 m.; St. 148: South Georgia, 132–148 m.; St. 159: South Georgia, 160 m.; St. 160: Shag Rocks, 177 m.; St. 175: South Shetlands, 200 m.; St. WS 42: South Georgia, 198 m.

REMARKS. Except that the chelae seldom exceed 0·03 mm. length, and that trichodragmata, measuring 0·03 × 0·006 mm., are present in small quantities, this specimen is quite typical.

DISTRIBUTION. Wilhelm Land; Victoria Land.

Section *CLATHRIEAE*

Genus Clathria, Schmidt

Clathria papillosa, Thiele.

C. papillosa, Thiele, 1905, p. 449, fig. 66.

Occurrence. St. WS 81: Falkland Islands, 81–82 m.; St. WS 83: Falkland Islands, 129–137 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 88: Falkland Islands, 96–127 m.; St. WS 95: Falkland Islands, 108–109 m.

REMARKS. Apart from the arrangement of the skeleton, all six specimens are typical, except for negligible differences in the sizes of the spicules in two of them. The skeleton is a regular network of triangular mesh, the sides of the meshes being one spicule length only and composed of three to six spicules, with the acanthostyli confined to the nodes of the network. In two of the specimens a slight departure from this arrangement is found in that occasional fibres, formed of bundles of megascleres, are seen running perpendicularly to the surface. The arrangement of the skeleton is therefore not only more variable than is usual in the genus *Clathria* but is not very typical of that genus.

DISTRIBUTION. Calbuco.

Clathria toxipraedita, Topsent.

C. toxipraedita, Topsent, 1913, p. 620, pl. v, fig. 4, pl. vi, fig. 12.

Occurrence. St. 144: South Georgia, 155–178 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 33: South Georgia, 130 m.

REMARKS. The larger chelae, described by Topsent, are absent from this specimen, which agrees with the holotype in all other respects.

DISTRIBUTION. Burdwood Bank.

Clathria lipochela, sp.n. (Plate LV, figs. 6–7; Fig. 29).

Holotype. B.M. 28. 2. 15. 352.

Occurrence. St. 51: Falkland Islands, 105–115 m.

DIAGNOSIS. Sponge pedunculate, irregularly flabellate; surface uneven, porose; inhalant and exhalant openings not distinguishable as such; skeleton an irregular network of quadrate meshes in which stout primary fibres may be recognized running vertically to surface; fibres containing much spongin, cored by principal megascleres and echinated by acanthostyli; microscleres absent; principal megascleres smooth styli, occasionally sparingly spined near base, 0·21 by 0·009 mm.; echinating acanthostyli somewhat variable in size, with spines evenly distributed throughout their length and slightly more numerous at base, 0·09 by 0·006 mm.; auxiliary spicules subtylostyli, smooth, straight, arranged in bundles at right angles to dermis or scattered singly among meshes of main skeleton, 0·15 by 0·003 mm.

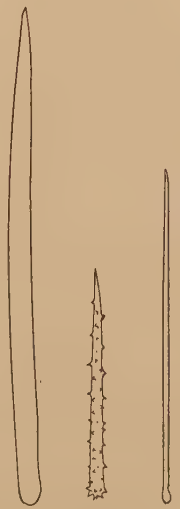

Fig. 29. *Clathria lipochela*, sp.n. Spicules, × 300.

REMARKS. There are few species of *Clathria* in which microscleres are entirely absent, and the present species is distinguished from all such hitherto described by the almost complete absence of spines on the principal megascleres. In appearance it resembles *Raspaxilla phakellina*, Topsent, but is distinguished from it by the absence of an axial skeleton and plumose columns of spicules, as well as by the absence of the peculiar acanthostyli in which the basal half is smooth.

Genus **Rhaphidophlus**, Ehlers

Rhaphidophlus paucispiculus, sp.n. (Plate LVI, fig. 1; Fig. 30).

Holotype. B.M. 28. 2. 15. 243.

Occurrence. St. 160: Shag Rocks, 177 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 109: Falkland Islands, 145 m.

DIAGNOSIS. Sponge massively flabellate, with tendency to give off digitate outgrowths, to massively branching; surface uneven and minutely conulose; oscules and pores not apparent; colour, in spirit, light brown; main skeleton composed of irregular bundles of styli running perpendicularly to surface or forming a confused reticulation of spicules lying at all angles to each other; smaller styli, differing from styli of main skeleton only in size, are scattered between fibres of main skeleton and also form a dense dermal skeleton; dermal skeleton consisting of a tangential layer of smaller styli with brushes of similar spicules situated immediately beneath and lying at right angles to it; styli of main skeleton smooth, slightly curved, 0·54–0·71 by 0·024–0·027 mm.; auxiliary styli, in dermal skeleton and scattered between meshes of main skeleton, 0·24–0·31 by 0·006–0·009 mm.

REMARKS. The species appears to be a typical *Rhaphidophlus*, but differs from all other species of that genus in the absence of echinating acanthostyli and microscleres. There appears to be little difference between the styli of the dermal skeleton and the auxiliary styli scattered between the meshes of the main skeleton, and for this reason they have been treated in the diagnosis as one form. There may possibly be a slight difference in size, but if so it is hard to appreciate this difference. Further, it is worth noting that intermediates between the larger and smaller styli also appear to be present, but whether they are very young forms of the larger styli or half-grown forms of the smaller spicules is again difficult to determine.

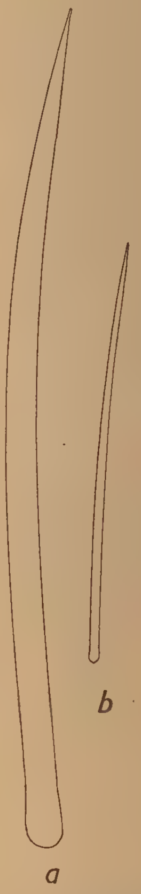

Fig. 30. *Rhaphidophlus paucispiculus*, sp.n. Spicules from *a*, main skeleton; *b*, dermis. × 200.

Genus **Protoclathria**, gen.n.

DIAGNOSIS. Clathrieae with skeleton composed of tylostyli and acanthostrongyla, arranged in a triangular network; there is no dermal skeleton and microscleres are absent.

Remarks. The genus, with its extremely simple skeleton, is not easy to classify. The presence of acanthostrongyla suggests at once an affinity with the Ectyoninae, and, for the time being at all events, I propose to regard it as a primitive Ectyonine, preferably as one of the Clathrieae.

Protoclathria simplicissima, sp.n. (Plate LVI, fig. 2; Fig. 31).

Holotype. B.M. 28. 2. 15. 369.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

Diagnosis. Sponge pyriform or massive, irregular; surface even, hispid; oscules and pores not apparent; texture firm but friable; colour, in spirit, dark grey; skeleton sub-isodictyal, consisting of a densely knit triangular mesh, usually multispicular but often unispicular in patches; no special dermal skeleton; little or no spongin; microscleres of two kinds only, tylostyli and acanthostrongyla; tylostyli, forming bulk of skeleton, usually curved or even strongly angulated at or near the centre, often reduced to styli or, more rarely, to oxea, 0·26 by 0·015 mm.; acanthostrongyla, of very rare occurrence, not echinating the skeleton but occupying same relative position as tylostyli, straight, 0·18 by 0·012 mm.

Remarks. In deciding the systematic position of this species, the difficulty is increased by the distribution of the acanthostrongyla. In the holotype they are numerous; in the first co-type they are rare; and in the third specimen they appear to be absent altogether. In the last therefore the skeleton consists only of tylostyli, and the sponge might well have been placed among the Suberitidae had it not been possible to make a comparison with the first two specimens.

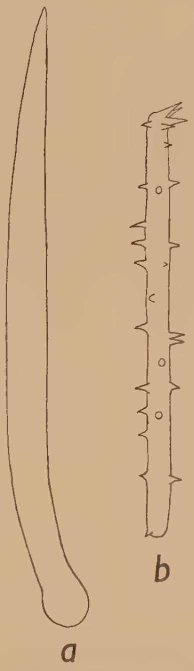

Fig. 31. *Protoclathria simplicissima*, sp.n. *a*, substylostyle; *b*, acanthostyle. × 320.

Genus **Ophlitaspongia**, Bowerbank

Ophlitaspongia membranacea, Thiele.

O. membranacea, Thiele, 1905, p. 450, figs. 67, 105.

Occurrence. St. 152: South Georgia, 245 m.

Remarks. The two specimens show a marked resemblance to the holotype of *O. membranacea*, Thiele, in the shape and disposition of the spicules, but differ in the external form and in the dimensions of the spicules. The first specimen consists of an erect digitate lobe bearing a small lateral branch, while the second is massive with incipient digitate processes at the top. Both have, however, a strongly hirsute surface as in the holotype. In the second specimen the smaller megascleres measure 0·5 by 0·024 mm. and the larger 1·2 by 0·036 mm. The auxiliary subtylostyli ("dünnen Style" of Thiele, *loc. cit.*, p. 451) measure 0·3 by 0·003 mm. In the first specimen, the dimensions of these spicules are much the same except that the larger megascleres often attain a length of

1·5 mm. The chelae are rare in the second specimen and do not exceed 0·006 mm. in length, and are apparently absent in the first. The toxa in both range from 0·7 to 0·07 mm. long, the larger being 0·006 mm. thick and strongly spined at the ends.

In spite of the differences from the holotype, I have little hesitation in identifying these two specimens with Thiele's species. The differences in the external form are comparatively unimportant, and the differences in the measurements of the spicules are no greater than those found in the various specimens assigned to *O. thielei* (see below), a closely related species. Regarding the toxa, it is of interest to note that in *O. thielei* the large toxa are often rare and difficult to find, and it is possible that large toxa are present in the holotype of *O. membranacea* but in such small quantities as to be readily overlooked. Even if they are actually absent, in view of the observations made on *O. thielei* I should still feel justified in identifying the two present specimens with Thiele's species.

Table showing dimensions of spicules in O. membranacea.

Station No.	Styli	Subtylostyli	Toxa	Chelae
42	0·48 × 0·028	0·30 × 0·006	0·1–0·42, scarce, especially the larger forms	0·012
42	0·45 × 0·024	0·30 × 0·006	0·03–0·22, rare, especially the larger forms	0·01
148	0·38 × 0·013	0·23 × 0·006	0·12–0·3, small toxa rare	0·012
156	0·36 × 0·015	0·24 × 0·006	0·35–0·24, all forms rare, but more particularly the larger	0·015
WS 25	0·36 × 0·021	0·30 × 0·006	0·065–0·48, abundant	0·009
WS 25	0·51 × 0·018	0·32 × 0·006	0·09 × 0·54, small forms rare	0·013

The measurements of the spicules, which are averages, are given in mm.

DISTRIBUTION. Juan Fernandez.

Ophlitaspongia thielei, sp.n. (Plate LV, fig. 8; Fig. 32).

Holotype. B.M. 28. 2. 15. 219.

Occurrence. St. 42: South Georgia, 120–204 m.; St. 148: South Georgia, 132–148 m.; St. 156: South Georgia, 200–236 m.; St. WS 25: South Georgia, 18–27 m.

DIAGNOSIS. Sponge massive; surface hispid and produced into papillate processes or meandrine ridges which may be so strongly developed as to give a clathrate appearance, or may be reduced to a feeble furrowing; pores apparently small and simple, and scattered evenly throughout dermis; oscules circular, 1–2 mm. in diameter, with delicate membranous velum, leading into cavernous sub-dermal crypts; often there is a single deep cloaca with a number of smaller oscules scattered over surface generally; texture firm and slightly compressible; skeleton a dense or feebly knit reticulation of styli, often showing strongly marked primary fibres which project slightly beyond ectosome as surface brushes; auxiliary spicules, found chiefly associated with dermal brushes, slender subtylostyli; microscleres toxa and chelae; styli of main skeleton slightly curved, 0·36–0·51 by 0·013–0·028 mm.; auxiliary subtylostyli, straight with crown of spines at basal end and with distal end pointed or, occasionally, blunted and spined, 0·23–0·32 by 0·006 mm.; toxa of varying size, smaller forms slender and strongly bent, larger stout and strongly spined at ends, 0·03–0·54 mm. long; isochelae palmatae, 0·009–0·015 mm. chord.

Remarks. The species is characterized by its external form and by the character of the microscleres. In many respects it resembles *Artemisina dianae*, Topsent, and forms, in fact, a connecting link between the two genera *Ophlitaspongia* and *Artemisina*, so that it becomes a matter of doubt whether these two genera can be maintained.

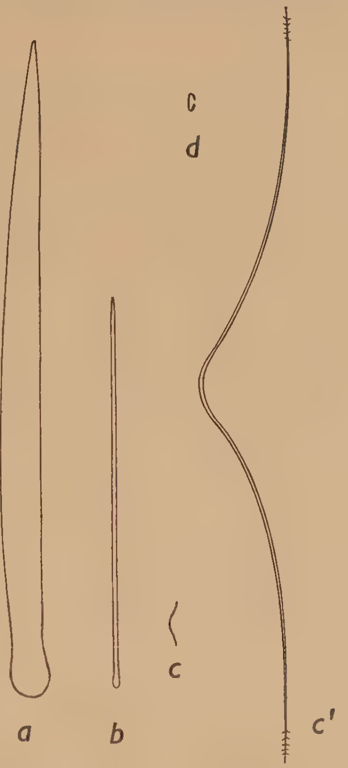

Fig. 32. *Ophlitaspongia thielei*, sp.n. *a*, style of main skeleton; *b*, auxiliary subtylostyle; *c*, *c'*, toxa, showing extremes in size; *d*, chela. All × 200.

Genus Artemisina, Vosmaer

Artemisina apollinis (Ridley and Dendy).

(For synonymy see Burton, 1929, p. 431.)

Occurrence. St. 42: South Georgia, 120–204 m.

Distribution. Wilhelm Land; Victoria Land; Graham Land; Kerguelen; North Atlantic.

Artemisina plumosa, Hentschel.

A. plumosa, Hentschel, 1914, p. 70, pl. iv, fig. 5, pl. vi, fig. 1; *A. plumosa*, var. *lipochela*, *id.*, *loc. cit.*, p. 72; *A. strongyla*, *id.*, *loc. cit.*, p. 72, pl. vi, fig. 2.

Occurrence. St. WS 109: Falkland Islands, 145 m.

Remarks. An irregularly branching and anastomosing specimen having the general external characters of *A. plumosa*, var. *lipochela*, and a similar skeleton except that microscleres appear to be quite absent.

Distribution. Wilhelm Land.

Genus **Dictyociona**, Topsent

Dictyociona discreta (Thiele) (Plate LVI, figs. 3–4).

Microciona discreta, Thiele, 1905, p. 447, fig. 65; *Dictyociona discreta*, Topsent, 1913, p. 618, pl. iii, fig. 5.

Occurrence. St. WS 79: Falkland Islands, 131–132 m.; St. WS 95: Falkland Islands, 108–109 m.; St. WS 243: Falkland Islands, 144–141 m.

REMARKS. On examining a piece of the holotype, I find that the smooth parts of the acanthostyli are not so well defined as Thiele's drawings would suggest. Usually spines are present on those parts, but they may be few and only feebly developed.

DISTRIBUTION. Calbuco; Gough Island.

Dictyociona terrae-novae (Dendy).

Clathria terrae-novae, Dendy, 1924, p. 353, pl. xii, fig. 5, pl. xiv, figs. 9–13.

Occurrence. St. 157: South Georgia, 970 m.

REMARKS. This species shows a strong likeness to *Clathria toxipraedita*, Topsent, and *C. mortenseni*, Brøndsted, and it is possible that all three may prove to be not only congeneric but also conspecific.

In the present specimen, the most noteworthy feature is the variability in the main megascleres, which show all stages between the large smooth styli and the acanthostyli. The main skeleton consists of columns of styli running towards the surface and connected at intervals by short fibres containing a few spicules only. The whole is echinated with acanthostyli. Auxiliary spicules in the form of slender subtylostyli are also present. The main megascleres are smooth styli in which the base may be entirely tuberculate or bear only a few tuberculations; or the spicule may be sparsely tuberculate throughout. The apex also may be simple, or spined, or truncate and tuberculate. The dimensions are 0·42 by 0·015 mm. The echinating acanthostyli are entirely spined, with the spines particularly concentrated at the base, and measure 0·18–0·27 by 0·003 mm. The auxiliary subtylostyli are smooth and straight, with a crown of inconspicuous spines at the base, and measure 0·105 by 0·008 mm. The microscleres are palmate isochelae, 0·011 mm. chord, and toxa, with spiny ends, 0·065–0·09 mm. long.

DISTRIBUTION. New Zealand.

Genus **Axociella**, Hallmann

Axociella nidificata (Kirkpatrick).

Ophlitaspongia nidificata, Kirkpatrick, 1907, p. 274; *id.*, 1908, p. 25, pl. xxii, fig. 6; pl. xxvi, fig. 5; *Axociella nidificata*, Burton, 1929, p. 433.

Occurrence. St. 148: South Georgia, 132–148 m.; St. 187: Palmer Archipelago, 259 m.; St. 190: Palmer Archipelago, 93–130 m.

DISTRIBUTION. Victoria Land.

Axociella flabellata (Topsent).

Ophlitaspongia flabellata, Topsent, 1916, p. 167; *id.*, 1917, p. 41, pl. i, fig. 4, pl. vi, fig. 2; *Axociella flabellata*, Burton, 1929, p. 433.

Occurrence. St. 140: South Georgia, 122–136 m.; St. 149: South Georgia, 200–234 m.

DISTRIBUTION. Graham Land; Victoria Land.

Genus **Pseudanchinoë**, Burton

Pseudanchinoë toxifera (Topsent).

Stylostichon toxiferum, Topsent, 1913, p. 621, pl. iv, fig. 7, pl. vi, fig. 14; *Anchinoë toxiferum*, subsp. *antarctica*, *id.*, 1917, p. 43, pl. iv, fig. 5, pl. vi, fig. 5; *Pseudanchinoë toxiferum*, Burton, 1929, p. 434.

Occurrence. St. 160: Shag Rocks, 177 m.; St. WS 237: Falkland Islands, 150–256 m.

DISTRIBUTION. Graham Land; Victoria Land; Gough Island.

Genus **Eurypon**, Gray

Eurypon miniaceum, Thiele.

E. miniaceum, Thiele, 1905, p. 446, fig. 64; *Raspailia irregularis*, Hentschel, 1914, p. 121, pl. viii, fig. 6.

Occurrence. St. 91: False Bay, South Africa, 35 m.; St. 156: South Georgia, 200–236 m.; St. 190: Palmer Archipelago, 93–130 m.

REMARKS. In external form, the two Antarctic specimens in the present collection are practically identical and are similar to *Raspailia irregularis*; but so far as the spiculation is concerned the first is almost indistinguishable from *R. irregularis* and the second from *Eurypon miniaceum*. The chief difference in spiculation between these two specimens is that the "eigenthümliche Acanthostyle" is absent in the one and present in the other, although when present this spicule is not quite typical, since the base is tylote or subtylostylote instead of stylote. Since the main difference between *Raspailia irregularis* and *Eurypon miniaceum* consists in the absence and presence respectively of this curious spicule, it seems almost certain in the light of the present observations that the two are identical. It appears probable that, in addition to its being of variable occurrence, the spicule is variable in form.

It is most surprising that a specimen of this species should have been found at False Bay, South Africa. This specimen is sub-spherical, with no visible point of attachment, and the surface is uneven, conulose and minutely hispid. The oscules and pores are probably situated in certain deep but irregular depressions found on the surface of the sponge. The spiculation appears to be typical except that all spicules are slightly smaller than those of the holotype and the "eigenthümliche Acanthostyle" is not to be found.

DISTRIBUTION. Calbuco, Chile.

Genus **Stylotellopsis**, Thiele

Stylotellopsis amabilis, Thiele.

S. amabilis, Thiele, 1905, p. 456, fig. 72.

Occurrence. St. WS 27: South Georgia, 106–109 m.; St. WS 83: Falkland Islands, 137–129 m.

Distribution. Punta Arenas.

Genus **Raspaxilla**, Topsent

Raspaxilla phakellina, Topsent.

R. phakellina, Topsent, 1913, p. 617, pl. i, fig. 4, pl. vi, fig. 15.

Occurrence. St. WS 81: Falkland Islands, 81–82 m.; St. WS 84: Falkland Islands, 75–74 m.

Distribution. Burdwood Bank.

Section *HYMEDESMIEAE*

Genus **Hymedesmia**, Bowerbank

Hymedesmia irritans, Thiele.

Desmacidon ceratosa, Thiele, 1905, p. 435, fig. 56; *Hymedesmia irritans*, *id.*, *loc. cit.*, p. 455, fig. 71. *Nec Amphilectus ceratosus*, Ridley and Dendy.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

Remarks. The present specimen has the form of a thin crust on a piece of coral. Its structure is quite typical except that the sigmata and forceps are extremely rare. Also, it may be noted that the acanthostyli are confined to those tissues immediately in contact with the coral.

From the observations made on the Discovery example of this species, it seems probable that *Desmacidon ceratosa* (Ridley and Dendy), Thiele, belongs to the same species. Both are encrusting, both possess amphitylota and chelae of the same size and shape. The differences between them rest in the absence of acanthostyli, sigmata and forceps in *D. ceratosa*. Since it has now been shown that these three forms of spicules may be either very rare or very inconspicuous, it is probable that more careful examination may reveal their presence in those forms identified by Thiele as *D. ceratosa*.

Hymedesmia, cf. laevis, Thiele.

H. laevis, Thiele, 1905, p. 453, fig. 69.

Occurrence. St. 58: Falkland Islands, 1–2 m.

Remarks. The specimen agrees well with the holotype of *Hymedesmia laevis*, Thiele, except that the tornota are mucronate at each end instead of simply strongylote.

Distribution. Calbuco, Chile.

Hymedesmia simillima, var. antarctica, Hentschel.

H. simillima, var. *antarctica*, Hentschel, 1914, p. 112.

Occurrence. St. WS 33: South Georgia, 130 m.; St. WS 225: Falkland Islands, 162–161 m.

Remarks. There is a slight difference from the holotype in the curvature of the shafts of the chelae.

Distribution. Wilhelm Land.

Hymedesmia longurioides, sp.n. (Fig. 33).

Holotype. B.M. 28. 2. 15. 468.

Occurrence. St. 160: Shag Rocks, 177 m.

Diagnosis. Sponge thinly encrusting; surface smooth, even; oscules in form of low chimney-like chones; pores not apparent; colour, in spirit, white; main skeleton composed of acanthostyli of two sizes; dermal skeleton an irregular tangential layer of tornota; large acanthostyli almost entirely spined, with swollen base, 0·35 by 0·016 mm.; small acanthostyli entirely spined, 0·105 by 0·008 mm.; dermal tornota smooth, straight, sharply but abruptly pointed at each end, 0·32 by 0·007 mm.

Remarks. The acanthostyli are apparently divided into two distinct categories with occasional intermediates. The surface of the sponge bears a number of low chimney-like chones, but whether these are poral or oscular, or both, it is difficult to say.

The species bears a resemblance to *H. longurius*, Lundbeck, but differs in the characters of the tornota.

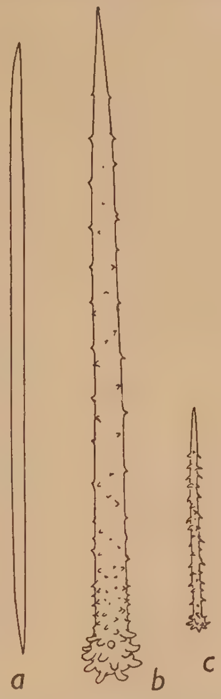

Fig. 33. *Hymedesmia longurioides*, sp.n. *a*, dermal tornote; *b* and *c*, acanthostyli. × 300.

Section *CRELLEAE*

Genus Crella, Gray

Crella crassa (Hentschel).

Grayella crassa, Hentschel, 1914, p. 95, pl. vii, fig. 3.

Occurrence. St. 175: South Shetlands, 200 m.

Distribution. Wilhelm Land.

Genus Crellina, Hentschel

Crellina tubifex, Hentschel.

C. tubifex, Hentschel, 1914, p. 110, pl. iv, fig. 12, pl. vii, fig. 14.

Occurrence. St. 175: South Shetlands, 200 m.

Distribution. Wilhelm Land.

Family AXINELLIDAE

Genus Hymeniacidon, Bowerbank

Genotype. Hymeniacidon caruncula, Bowerbank, 1858, p. 286 (*fide* Thiele, 1905, p. 421).

DIAGNOSIS. Axinellidae possessing styli only; main skeleton a confused reticulation; with special dermal skeleton in form of tangential layer of irregularly scattered spicules.

Hymeniacidon caruncula, Bowerbank, Autt.

Occurrence. On the beach, Saldanha Bay.

REMARKS. The two specimens appear to be identical with those described by Stephens (1915, p. 438) from the same locality.

DISTRIBUTION. From the Arctic down the eastern shores of the Atlantic to Saldanha Bay.

Hymeniacidon sanguinea (Grant), Autt.

Occurrence. St. 271: Elephant Bay, Angola, 0–5 m.

REMARKS. An orange-coloured sponge encrusting clumps of *Ostrea*.

DISTRIBUTION. North Atlantic and Arctic Oceans.

Hymeniacidon fernandezi, Thiele.

H. fernandezi, Thiele, 1905, p. 422; Topsent, 1913, p. 615, pl. iii, fig. 6.

Occurrence. St. 53: Falkland Islands, 0–2 m.; St. 145: South Georgia, 26–35 m.; St. 160: Shag Rocks, 177 m.; St. WS 27: South Georgia, 106–109 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 85: Falkland Islands, 79 m.

REMARKS. One specimen is growing amidst the branches of an alga, in company with *Iophon unicornis*. In external appearance it resembles the specimen figured by Topsent (*loc. cit.*), while its skeleton is very like that of the holotype, with which I have been able to make a comparison. The styli measure 0·3 by 0·008 mm.

A second specimen is massive and low-lying, encrusting fragments of shells. The spicules measure 0·2 by 0·005 mm. and the sponge resembles very closely in appearance and texture the specimens recorded above under *H. caruncula*, Bowerbank.

There is little doubt, as Topsent has suggested, that the present species has a close affinity with *H. caruncula*, and it is difficult to see how a distinction between the two species can be made except on the grounds of small differences in the size of their respective spicules. Until the variations in *H. caruncula* have been carefully studied, however, it is better to regard the two species as distinct.

DISTRIBUTION. Juan Fernandez; Falkland Islands.

Hymeniacidon torquata, Topsent.

H. torquata, Topsent, 1916, p. 166; *id.*, 1917, p. 40.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

REMARKS. The single specimen is doubtfully assigned to this species.

DISTRIBUTION. Petermann Island.

Hymeniacidon dubia, sp.n. (Plate LVI, fig. 9; Fig. 34).

Holotype. B.M. 28. 2. 15. 364.

Occurrence. St. WS 83: Falkland Islands, 137–129 m.

DIAGNOSIS. Sponge massive, clathrate; surface minutely hispid and beset with warty protuberances, as though sponge body were composed of numerous thickly-set branches which had anastomosed, leaving stunted ends exposed at surface; oscules not seen; skeleton a confused reticulation of, usually, single spicules; spicules styli, usually thickest at centre and tapering away at each end, 0·48 by 0·11 mm.

REMARKS. The species approximates more closely to *Axinella verrucosa*, Brøndsted, from New Zealand, than to any other species of Axinellidae. It differs from that species in the absence of spicule fibres and of strongyla and in the size of the spicules. The most important feature they have in common is that the styli are thickest at the centre and thence taper gently towards each end, in the manner of the megascleres of *Polymastia*, instead of having the same diameter throughout their length except at the distal end where they taper to a point, as in the typical Axinellid style. In all respects, however, the present species is a typical *Hymeniacidon*. Further, many of the spicules, smaller than the rest and probably only young forms, are regularly stylote, as in the typical Axinellid.

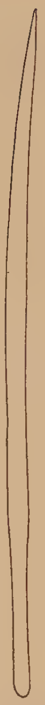

Fig. 34. *Hymeniacidon dubia*, sp.n. Style, × 200.

Genus **Thieleia**, gen.n.

Genotype. Hymeniacidon rubiginosa, Thiele.

DIAGNOSIS. Main skeleton composed of delicate strands of spicules running vertically to the surface and connected to each other by irregularly arranged masses of single spicules. At the surface, the ends of the strands diverge to form dense brushes of spicules the apices of which project slightly beyond the dermis. There is no special dermal skeleton, unless the dense brushes formed from the ends of the strands of the main skeleton can be regarded as such.

Thieleia rubiginosa (Thiele).

Hymeniacidon rubiginosa, Thiele, 1905, p. 421, fig. 44.

Occurrence. St. 157: South Georgia, 970 m.

DISTRIBUTION. Iquique.

Analysis of the species of Hymeniacidon *of the South Atlantic-Antarctic region*

Of the numerous species hitherto assigned to the genus *Hymeniacidon*, the majority have proved to be synonyms of *H. caruncula* and *H. sanguinea*, or are now known to belong to other genera. Of the remainder, five are recorded from the South Atlantic-Antarctic region.

H. fernandezi, Thiele, 1905, p. 422. Skeleton arranged as in *H. caruncula*.

H. kerguelensis, Hentschel, 1914, p. 123. Skeleton as in *H. caruncula*.

H. torquata, Topsent, 1917, p. 40. I have not seen a specimen of this species, but by comparing Topsent's description with a portion of the holotype of *H. rubiginosa* there appears to be little doubt that the two species are synonymous. According to its author, the spicules of *H. torquata* are "généralement marqués près de leur base d'un léger bourrelet qui la renfle en base de subtylostyle". The same may be said of *H. rubiginosa*.

H. centrotyla, Hentschel, 1914, p. 125. Skeleton as in *Thieleia rubiginosa* (Thiele).

Genus **Axinella**, Schmidt

Axinella crinita, Thiele.

A. crinita, Thiele, 1905, p. 424, fig. 46.

Occurrence. St. WS 82: Falkland Islands, 140–144 m.

DISTRIBUTION. Calbuco, Chile.

Genus **Pseudaxinella**, Thiele

Pseudaxinella egregia (Ridley).

Phakellia egregia, Ridley, 1881, p. 114, pl. x, fig. 6; *Pseudaxinella egregia*, Thiele, 1905, p. 426, fig. 47.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

REMARKS. In his original preparations I find all the spicules Ridley has described with the exception of the "Setaceous acuate". This I have been quite unable to find. It must be assumed, therefore, that either this particular spicule is extremely rare or that Ridley himself has made some mistake about it. The longest spicules in his preparations do not exceed 0·9 mm. Thiele also remarks that the spicules over 0·8 mm. in length were very rare in his Calbuco sponge.

The present specimens agree closely with the holotype except that the spicules are more robust and the oxea much more numerous. One specimen is sub-cylindrical, presumably erect, the other massive, almost pyriform.

DISTRIBUTION. Calbuco and Sandy Point (South America).

Genus **Homaxinella**, Topsent

Homaxinella supratumescens (Topsent).

(For synonymy see Burton, 1929, p. 443.)

Occurrence. St. 148: South Georgia, 132–148 m.; St. WS 62: South Georgia, 15–45 m.; St. MS 14: South Georgia, 190–110 m.

REMARKS. The first specimen is quite typical in all respects. So also is the second, except that it is attached at the base to the spine of an Echinoderm. The third specimen consists of a group of three apparently very young specimens, which support Topsent's (1908, p. 33) view that the species is characterized by rapid growth. The smallest is 100 mm. high and 1·5 mm. thick, the largest 180 mm. high and 2 mm. thick. The body of the sponge in each case can only be described as incipient, consisting of an inconspicuous feathery structure occupying the upper third of the stalk, resembling in appearance that of *Asbestopluma pennatula*, Schmidt (see Lundbeck, 1905, pl. ii, fig. 1). The stalk is evidently very quick growing, for it reaches a considerable height before the body even begins to take form, a state of affairs very similar to that in *Stylocordyla borealis* (Lovén) (see Burton, 1928, p. 68).

DISTRIBUTION. Graham Land; Victoria Land; Wilhelm Land.

Genus **Rhizaxinella**, Keller

Rhizaxinella australiensis, Hentschel.

R. australiensis, Hentschel, 1909, p. 397, pl. xxii, figs. 4, 5; text-figs. 27, 28; Burton, 1929, p. 443.

Occurrence. St. 158: South Georgia, 401–411 m.; St. 175: South Shetlands, 200 m.; St. 190: Palmer Archipelago, 93–130 m.; St. WS 225: Falkland Islands, 162–161 m.

DISTRIBUTION. Australia; Victoria Land.

Genus **Stylohalina**, Kirk

Stylohalina hirta (Topsent) (Fig. 35).

Amorphina hirta, Topsent, 1889, p. 44, fig. 9 A.

Occurrence. St. 283: Gulf of Guinea, 18–30 m.

REMARKS. The larger of the two specimens is 2 cm. by 2 cm. across the base, and 1 cm. high, massive with very uneven surface in the sense that it is thrown into irregular ridges and depressions, and with the surface further thrown into minute tubercles and cerebriform ridges. The skeleton consists only of styli, 0·78 by 0·014 mm., which are "remarquables par une courbure constante bien accentuée à peu de distance de la grosse extrémité".

The external form of the present specimens is very like that of the holotype, except that the surface is not raised into "des projections grêles et hispides", although it is minutely hispid throughout. Unfortunately, Topsent says nothing about the structure of the skeleton, but as the two specimens agree so closely in all other respects, I feel sure that the present specimen is conspecific with the holotype of *Amorphina hirta*, despite

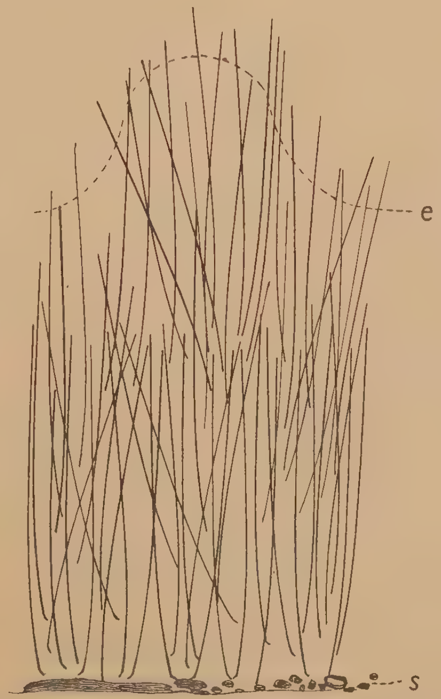

Fig. 35. *Stylohyalina hirta* (Topsent). Section at right angles to surface, to show the arrangement of the skeleton. *e*, ectosome, *s*, substratum.

the fact that they were found at opposite sides of the Atlantic. The skeleton in the present specimen consists of loose bundles of styli running from the substratum to the surface (Fig. 29).

Distribution. West Indies.

Genus **Plicatellopsis**, gen.n.

Genotype. P. arborescens, sp.n.

Diagnosis. Axinellidae with main skeleton a confused or regular reticulation of styli or tylostyli from which ascending fibres pass outwards to dermis; dermal skeleton in form of bundles of small styli or tylostyli; interstitial spicules, when present, long slender tylostyli.

Remarks. The genus includes, in addition to the genotype, *P. flabellata*, sp.n. and *Plicatella expansa*, Thiele. The use of Schmidt's genus *Plicatella* (1870, p. 45: genotype, *Reniera labyrinthica*, Schmidt, 1864, p. 39, pl. iv, fig. 9) by Thiele is unjustified, since the only information we have is that the skeleton contains styli only. We know nothing of the arrangement of these styli, and it is probable that *Plicatella* is more closely related to *Stylohalina* than to any other genus. At the same time, there is a close relation between *Plicatella* and *Plicatellopsis*; but until the type of the former is redescribed it will be impossible to define it.

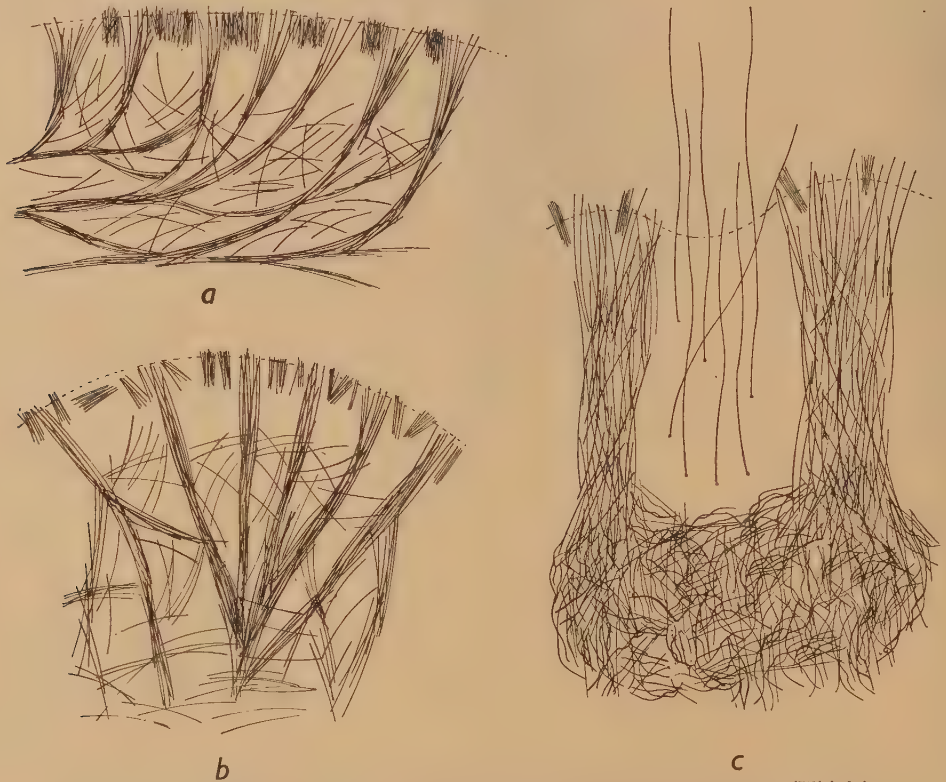

Fig. 36. Showing arrangement of skeleton in *a*, *Plicatellopsis expansa* (Thiele), *b*, *P. arborescens*, sp.n., *c*, *P. flabellata*, sp.n.

Plicatellopsis arborescens, sp.n. (Plate LVI, fig. 5; Figs. 36 *b*, 37 *b*).

Holotype. B.M. 28. 2. 15. 388.

Occurrence. St. WS 83: Falkland Islands, 137–129 m.; St. WS 243: Falkland Islands, 144–141 m.

Diagnosis. Sponge erect, dichotomously branched; surface even, minutely hispid; texture firm, compressible, friable; oscules and pores not apparent; colour, in spirit, brown; skeleton an irregular reticulation of large styli giving off fibres which run vertically to surface; special dermal skeleton of bundles of small styli associated with outermost ends of ascending main fibres; large styli, slightly curved, 0·65 by 0·025 mm.; small styli, straight or slightly curved, 0·28 by 0·007 mm.

Remarks. The skeleton is rather confused, its plan being obscured by the abundance of isolated spicules scattered between the main fibres. The small styli are chiefly confined to the dermis although a few, not in bundles, are to be seen scattered between the meshes of the main skeleton. There is no visible spongin.

The species differs from *P. expansa*, Thiele (Figs. 36 *a*, 37 *a*) in the external form and in the absence of any tylostyli.

Plicatellopsis flabellata, sp.n. (Plate LVI, fig. 6; Figs. 36 *c*, 37 *c*).

Holotype. B.M. 28. 2. 15. 726.

Occurrence. St. WS 84: Falkland Islands, 75–74 m.

Diagnosis. Sponge irregularly flabellate, somewhat plicated; surface minutely tuberculate, markedly hispid; texture soft, friable; oscules and pores not apparent; colour, in spirit, brown; internal skeleton a confused mass of tylostyli, crossing each other at all angles, from which irregular fibres run vertically to surface; special dermal spicules in form of small styli; with long, slender tylostyli lying between ascending fibres of main skeleton; tylostyli of main skeleton usually much curved, 0·4 by 0·014 mm.; small styli of dermal skeleton, 0·2 by 0·003 mm.; long, slender, flexuous tylostyli, 2·0 by 0·01 mm.

Remarks. There is a marked relation between this species and *P. expansa*, Thiele (cf. Figs. 34 *a*, 35 *a*), and *P. arborescens*, sp.n., but it differs from both in external form, in the disposition of the skeleton and in having tylostyli in the main skeleton and small styli for dermal spicules.

Genus **Bubaris**, Gray

Bubaris vermiculata (Bowerbank).

(For synonymy see Dendy, 1924, p. 351.)

Occurrence. St. 6: Tristan da Cunha, 80–140 m.; St. 283: Gulf of Guinea, 18–30 m.

Distribution. Throughout Atlantic Ocean; Kerguelen; New Zealand.

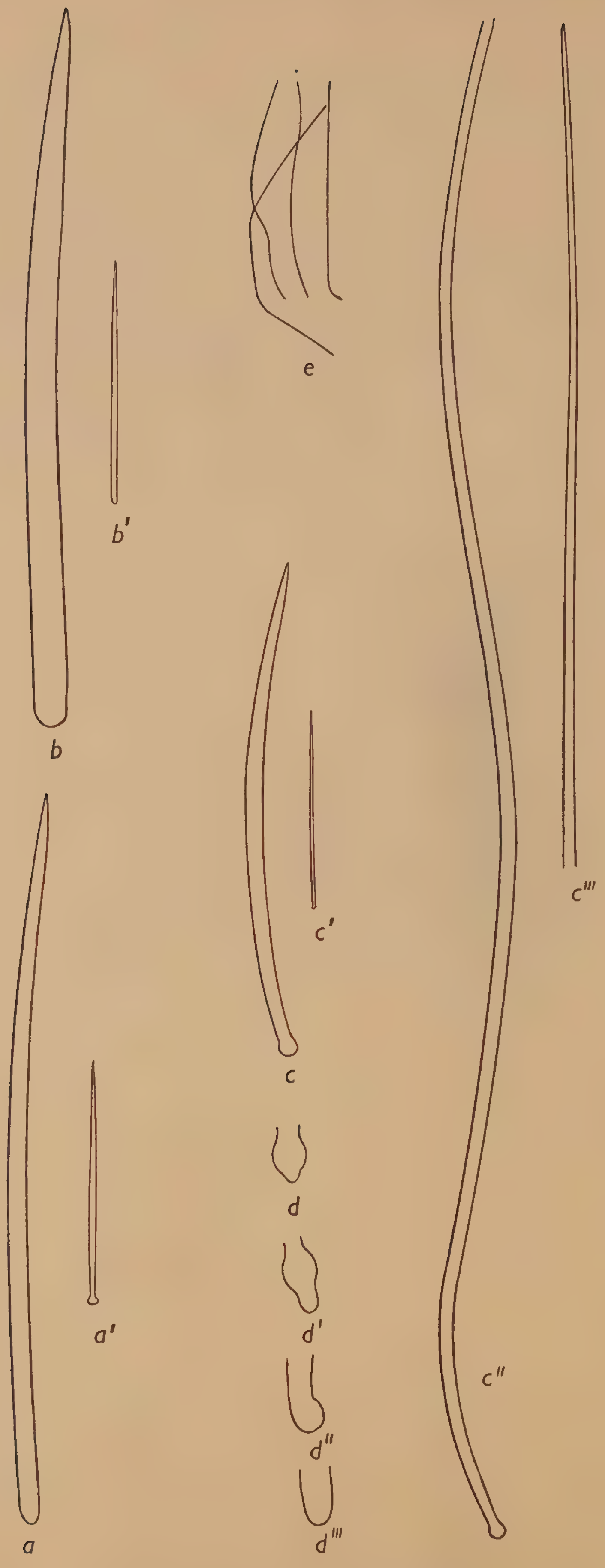

Fig. 37. *a*, *Plicatellopsis expansa* (Thiele), large style and small tylostyle; *b*, *P. arborescens*, sp.n., large and small styli; *c–e*, *P. flabellata* (*c* = tylostyle of main skeleton, *c′* small style, *c″*, *c‴* long flexuous tylostyle, *d–d‴* bases of tylostyli of main skeleton, *e* showing shapes of main tylostyli).

Bubaris murrayi, Topsent.

B. murrayi, Topsent, 1913, p. 616, pl. iii, fig. 1.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

REMARKS. It is probable that this species is synonymous with *B. vermiculata*.

DISTRIBUTION. Gough Island.

Genus **Ceratopsis**, Thiele

Ceratopsis incrustans, sp.n. (Fig. 38).

Holotype. B.M. 28. 2. 15. 435.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

DIAGNOSIS. Sponge encrusting; surface even, minutely conulose; oscules and pores not apparent; texture soft, compressible; colour, in spirit, grey; skeleton a multispicular subisodictyal reticulation of styli of two sizes, larger 0·48 by 0·015 mm. and smaller 0·3 by 0·006 mm.; microscleres, toxiform microxea, 0·1 by 0·004 mm., scattered throughout choanosome.

REMARKS. The species differs from all previously known members of the genus *Ceratopsis* in the dimensions of its spicules and in its external form.

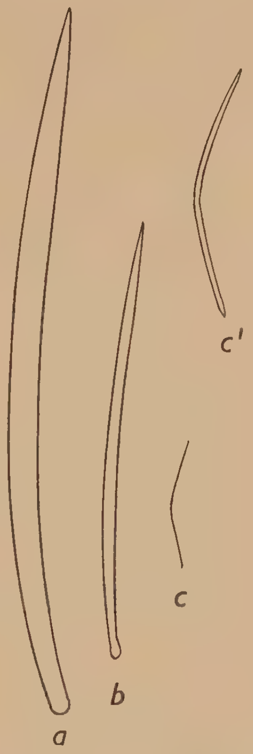

Fig. 38. *Ceratopsis incrustans*, sp.n. *a*, large style; *b*, small style; *c*, *c'*, toxiform microxeote. *a*, *b* and *c*, × 200; *c'*, × 400.

Genus **Eumastia**, Schmidt

Eumastia attenuata, Topsent.

E. attenuata, Topsent, 1915, p. 35, figs. 1, 2.

Occurrence. St. 53: Falkland Islands, 0–2 m.

DISTRIBUTION. Falkland Islands.

Family CLAVULIDAE

Genus **Suberites**, Nardo

Suberites montiniger, Carter.

S. montiniger, Carter, 1880, p. 256; Vosmaer, 1882, p. 31, pl. i, fig. 26, pl. iv, figs. 137–139; Topsent, 1892, p. 130; Lambe, 1894, p. 128, pl. iv, fig. 4; Swartschewsky, 1906, p. 319, pl. xiii, fig. 4; Topsent, 1915, p. 39; *Pseudosuberites montiniger*, Hentschel, 1916, p. 6; *Suberella topsenti*, Burton, 1929, p. 446, pl. iv, fig. 5.

Occurrence. St. WS 239: Falkland Islands, 196–193 m.

REMARKS. Since writing my Terra Nova Report, I have had occasion to examine a number of specimens of *S. montiniger*, Carter, from the northern hemisphere and am now convinced that the sponges recorded by Topsent (*loc. cit.*) and myself, from the Antarctic, are identical with Carter's type.

DISTRIBUTION. Burdwood Bank; Victoria Land.

Suberites microstomus, Ridley and Dendy, var. **stellatus**, Kirkpatrick.

S. microstomus, var. *stellatus*, Kirkpatrick, 1908, p. 19, pl. xv, figs. 8–13.

Occurrence. St. 152: South Georgia, 245 m.; St. 190: Palmer Archipelago, 315 m.

DISTRIBUTION. Victoria Land.

Suberites papillatus, Kirkpatrick.

S. caminatus, var. *papillatus*, Kirkpatrick, 1908, p. 20, pl. xv, fig. 16, pl. xvi, figs. 11–14; *Tentorium papillatum*, Topsent, 1917, p. 36, pl. iv, fig. 2; *Suberites papillatus*, Burton, 1929, p. 445.

Occurrence. St. 156: South Georgia, 200–236 m.; St. 160: Shag Rocks, 177 m.; St. 170: Clarence Islands, 342 m.; St. 190: Palmer Archipelago, 93–130 m.

DISTRIBUTION. Graham Land; Victoria Land.

Genus **Pseudosuberites**, Topsent

Pseudosuberites hyalinus (Ridley and Dendy).

(For synonymy see Burton, 1929, p. 445.)

Occurrence. St. 6: Tristan da Cunha, 80–140 m.; St. 152: South Georgia, 245 m.; St. 157: South Georgia, 970 m.; St. WS 243: Falkland Islands, 144–141 m.

DISTRIBUTION. Europe; Red Sea; Patagonia; Graham Land; Victoria Land.

Pseudosuberites sulcatus, Thiele.

(For synonymy see Burton, 1929, p. 334.)

Occurrence. St. 58: Falkland Islands, 1–2 m.; St. 156: South Georgia, 200–236 m.; St. WS 86: Falkland Islands, 151–147 m.; St. WS 90: Tierra del Fuego, 82–81 m.; St. WS 91: Tierra del Fuego, 191–205 m.; St. WS 108: Falkland Islands, 118–120 m.

REMARKS. The collection includes an encrusting form, comparable with *Suberites incrustans*, Brøndsted, two encrusting forms with convoluted surface, and one massive specimen with papillate outgrowths resembling the holotype of the species. There are, in addition to these, five large irregularly flabellate specimens, but as this particular growth form is being dealt with in my forthcoming report on the sponges of the Swedish Antarctic Expedition I refrain from further comment here.

DISTRIBUTION. Tierra del Fuego; Gough Island; South Georgia; Victoria Land; Auckland and Campbell Islands.

Genus Tentorium, Vosmaer.

Tentorium semisuberites (Schmidt).

Thecophora semisuberites, Schmidt, 1870, p. 50, pl. vi, fig. 2; *T. ibla*, Thompson, 1873, p. 148, fig. 24; *T. semisuberites*, Whiteaves, 1874, p. 9; *T. ibla*, Verrill, 1874, p. 500, pl. viii; *T. semisuberites*, Vosmaer, 1885, p. 18, pl. i, figs. 23, 24, pl. iii, figs. 22–26; *Tentorium semisuberites*, *id.*, 1885, p. 329, pl. ii, fig. 4, pl. xxi, fig. 19; Ridley and Dendy, 1886, p. 489; *id.*, *loc. cit.*, p. 221; *Thecophora semisuberites*, Fristedt, 1887, p. 433; *Tentorium semisuberites*, Lambe, 1896, p. 198, pl. iii, fig. 2; *id.*, 1900, p. 25; Arndt, 1912, p. 113; Topsent, 1913, p. 25; Ferrer, 1914, p. 19.

Occurrence. St. 6: Tristan da Cunha, 80–140 m.

DISTRIBUTION. Arctic and Atlantic Oceans.

Genus Polymastia, Bowerbank

Polymastia isidis, Thiele (Fig. 39).

P. isidis, Thiele, 1905, p. 414, figs. 25, 38 *a–e*; *P. isidis*, var. *simplex*, Hentschel, 1914, p. 47, pl. v, fig. 3.

Occurrence. St. 187: Palmer Archipelago, 259 m.; St. WS 81: Falkland Islands, 81–82 m.; St. WS 82: Falkland Islands, 140–144 m.; St. WS 86: Falkland Islands, 151–147 m.; St. WS 248: Falkland Islands, 210–242 m.; St. WS 250: Falkland Islands, 251–313 m.

REMARKS. The species is represented by nearly a dozen specimens, all agreeing closely with each other, but differing slightly from the holotype in external form and minor details of the spiculation. They are all cushion-shaped, standing on a circular base, and the upper surface bears a varying number of wart-shaped papillae. The papillae are never elongate, as in the type, but always low, not exceeding 2–3 mm. in height, and in some not perceptibly raised above the level of the surrounding surface. The chief difference in the spiculation is the presence of a peculiar annulation on many of the large tylostyles. The normal base of these tylostyles is as shown in Fig. 39 *c*, but more than 50 per cent have a base such as that shown in Fig. 39 *b*, while Fig. 39 *a* represents the condition in about 10 per cent. Many of these spicules are polytylote, as in the type, but wherever this occurs the swellings on the shafts are of the kind shown in Fig. 39 *a*.

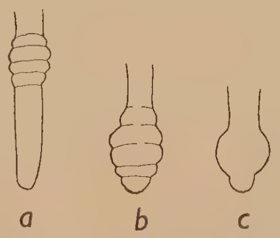

Fig. 39. *Polymastia isidis*, Thiele; showing variations in shape of bases of megascleres. × 300.

At first sight, it would appear that the differences between the specimens here described and the type of the species are sufficient to justify the recognition of a new variety, but the general similarity in texture, appearance of the surface, disposition of the spicules in the skeleton, and the shape of the normal megascleres make it fairly certain that the Discovery specimens represent at the most a tropus (*sensu* Vosmaer) of *P. isidis*.

Making this more certain, there are a further nine specimens in the collection which resemble closely in external appearance the dozen specimens referred to above. These are mostly cushion-shaped, but one is irregularly massive and one sub-spherical. The surface of each is even and only minutely hispid; and in most of them the papillae are less than 3 mm. high, but in two they are 5 mm. or more high and agree closely with those of the holotype. As regards the spiculation, the larger megascleres in most of these nine specimens have the same type of base figured by Thiele (*loc. cit.*) for the holotype, a few show traces of the annulation recorded above for the first group of specimens, and in a few this annulation is fairly strongly marked. In some of the specimens, also, there is no trace of the polytylote megascleres. We see in this group therefore a series of typical specimens, together with all transitions between them and the group of abnormal specimens described above.

The differences between the typical form and Hentschel's var. *simplex* are so slight, especially when compared with those found in the present specimens, that I can see no reason at all for maintaining this variety. In fact, if we compare the relation between the holotype and Hentschel's specimen with the relations between the various individuals recorded under *P. mammillaris*, or any other species of *Polymastia*, there is not the slightest justification for the introduction of this variety.

It is probable, to judge by the written description, that Brøndsted's (1923) *P. granulosa* from the Auckland and Campbell Islands will also prove to be synonymous with *P. isidis*.

DISTRIBUTION. Falkland Islands; Wilhelm Land.

Polymastia invaginata, Kirkpatrick.

P. invaginata, Kirkpatrick, 1907, p. 271; *id.*, 1908, p. 15, pl. xii, fig. 1, pl. xiv, figs. 5–15; *P. invaginata*, var. *gaussi*, Hentschel, 1914, p. 49, pl. v, fig. 4; *P. invaginata*, Burton, 1929, p. 446.

Occurrence. St. 42: South Georgia, 120–204 m.; St. 156: South Georgia, 200–236 m.; St. 167: South Orkneys, 244–344 m.; St. 177: South Shetlands, 1080 m.

REMARKS. There are three specimens of this species which, although typical in all essential respects, differ in appearance and in the disposition of the spicules; and these differences seem to have a bearing on the problem of the extrusion of spicules. The first specimen is cupola-shaped, 2 cm. across and 1 cm. high, with smooth minutely hispid surface and normal spiculation. That is to say, the large megascleres are arranged in regular radial bundles and the smaller spicules in a dermal palisade and in stellate groups within the choanosome. There are no large spicules protruding at the surface. The second specimen is sub-spherical, 2 cm. in diameter, and in this the surface is smooth, or only minutely hispid, for the most part, but bears several patches of long protruding spicules. The general appearance is, in fact, very like that of a long-haired mammal in the last stages of shedding its coat. Moreover, the spicules composing these shaggy patches are not firmly embedded in the tissues, but may be removed with the greatest ease, and without the use of the slightest force, with a pair of forceps. Internally, the spiculation is not quite normal. The radial bundles are normal, but the characteristic stellate groups of small megascleres are not to be seen, these spicules being irregularly scattered through the choanosome. The third specimen, incomplete but larger than the two preceding specimens, is very conspicuously shaggy throughout the whole surface. Internally, the spiculation is very disordered: the smaller megascleres are most irregularly distributed and the larger megascleres are not only fewer in number than is usual but do not form the usual radial bundles. Instead they are arranged in a very confused manner.

I have (1931) suggested the possibility that the individuals of this species periodically extrude their spicules and the present specimens appear to offer strong support to this view. The first specimen is quite obviously in a normal condition. The third, equally obviously, is not, but has every appearance of being in the process of extruding the bulk of its larger megascleres at the surface. Specimen 2, on the other hand, appears equally certainly to be in the final stages of a "moult," with the remaining patches of the extruded spicules still loosely adhering to the surface, while internally the skeleton is resuming its normal arrangement.

DISTRIBUTION. Victoria Land; Wilhelm Land.

Genus Sphaerotylus, Topsent

Sphaerotylus antarcticus, Kirkpatrick.

(For synonymy see Burton, 1929, p. 446.)

Occurrence. St. 160: Shag Rocks, 177 m.

DISTRIBUTION. Victoria Land; Wilhelm Land.

Genus Stylocordyla, Thomson

Stylocordyla borealis (Lovén), subsp. **acuata**, Kirkpatrick.

S. borealis, var. *acuata*, Kirkpatrick, 1908, p. 22, pl. xvi, figs. 6–10; Hentschel, 1914, p. 34; *S. borealis*, subsp. *acuata*, Burton, 1928, p. 66, fig. 6; *S. borealis*, var. *acuata*, *id.*, 1929, p. 445.

Occurrence. St. 42: South Georgia, 120–204 m.; St. 123: South Georgia, 230 m.; St. 144: South Georgia, 155–178 m.; St. 160: Shag Rocks (depth doubtful); St. 167: South Orkneys, 244–344 m.; St. 175: South Shetlands, 200 m.; St. 177: South Shetlands, 1080 m.; St. 190: Palmer Archipelago, 93–130 m.

DISTRIBUTION. Victoria Land; Wilhelm Land.

Genus Spirastrella, Schmidt

Spirastrella purpurea (Lamarck) (Plate LVI, fig. 7).

(For synonymy see Vosmaer, 1911.)

Occurrence. St. 283: off Annobon, Gulf of Guinea, 18–30 m.

REMARKS. The specimen is similar to those figured by Vosmaer (*loc. cit.*, pl. iii, fig. 2, pl. iv, fig. 6) in appearance. The surface is obscured, except for papillate processes, by calcareous débris and much débris is included throughout the tissues. The habitus recalls that of *Spirastrella aurivilli* forma *excavans*, Lindgren (1898, p. 41) and the spicules are almost identical with those of *S. congenera*, Ridley (cf. Vosmaer, *loc. cit.*, pl. xii, fig. 1).

DISTRIBUTION. Indo-Australian area; West Indies.

Genus Latrunculia, Bocage

Latrunculia lendenfeldi, Hentschel.

L. lendenfeldi, Hentschel, 1914, p. 44, pl. v, fig. 1.

Occurrence. St. WS 81: Falkland Islands, 81–82 m.; St. WS 83: Falkland Islands, 137–129 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 88: Falkland Islands, 96–127 m.; St. WS 243: Falkland Islands, 144–141 m.; St. WS 246: Falkland Islands, 267–208 m.; St. WS 248: Falkland Islands, 210–242 m.

Distribution. Wilhelm Land, Antarctic.

Genus Cliona, Grant

Cliona aethiopicus, sp.n. (Fig. 40).

Holotype. B.M. 28. 2. 15. 724.

Occurrence. St. 283: Gulf of Guinea, 18–30 m.

Diagnosis. Tylostyli of usual form, 0·26 by 0·007 mm.; spirasters with short stout shaft and a few conical spines, 0·028 mm. long.

Remarks. The single specimen is found in a fragment of a thick (*Ostraea*?) shell. It resembles very closely *C. chilensis*, Thiele, but differs in the measurements of the spicules (in Thiele's species these are: tylostyli 0·3–0·33 by 0·017 mm., and spirasters 0·018 mm.). Had this specimen been found in a locality adjacent to the type locality, I should have had no hesitation in identifying it with *C. chilensis*, but the geographical separation combined with the differences in the dimensions of the spicules have caused me to regard it as a separate species.

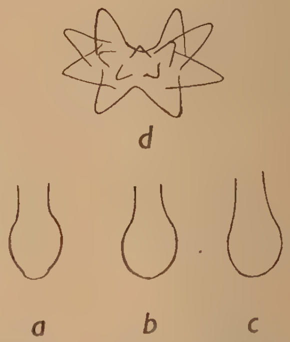

Fig. 40. *Cliona aethiopicus*, sp.n. *a–c*, bases of tylostyli, *a* being the more frequently found; *d*, spiraster, × 700.

Order EUCERATOSA

Genus Halisarca, Dujardin

Halisarca dujardini, Johnston, var. **magellanica**, Topsent.

H. dujardini, var. *magellanica*, Topsent, 1901, p. 44, pl. i, fig. 2, pl. vi, figs. 11–14; Burton, 1929, p. 414.

Occurrence. St. 55: Falkland Islands, 10–16 m.; St. 58: Falkland Islands, 1–2 m.; St. 222: Cape Horn, 30–35 m.; St. WS 79: Falkland Islands, 131–132 m.

Distribution. Victoria Land; Londonderry Island.

Genus Spongia, Linnaeus

Spongia officinalis, Linnaeus, Autt.

Occurrence. St. 1: Ascension Island, 16–27 m.

Remarks. The single specimen has the external form of *Euspongia officinalis adriatica* (Schulze, 1879, pl. xxxiv, fig. 2), but is black in colour.

Distribution. Mediterranean; West Indies; Indian Ocean; Australia.

Spongia magellanica, Thiele.

S. magellanica, Thiele, 1905, p. 483, figs. 18, 106.

Occurrence. St. 156: South Georgia, 200–236 m.; St. WS 84: Falkland Islands, 75–74 m.; St. WS 89: Tierra del Fuego, 23–21 m.

REMARKS. The fibres of the first specimen contain sand grains only, those of the second specimen contain only fragments of sponge spicules. Otherwise the two specimens are identical and both resemble the holotype closely.

DISTRIBUTION. Punta Arenas and Calbuco.

Genus **Duseideia**, Johnston

Duseideia fragilis (Montagu), Autt.

Occurrence. St. 1: Ascension Island, 16–27 m.

REMARKS. The specimen is thinly encrusting, but resembles the European forms of the species very closely in structure.

A synonymy of this species will be given in my report on the Barrier Reef sponges.

DISTRIBUTION. Practically cosmopolitan.

Duseideia chilensis (Thiele).

Spongelia chilensis, Thiele, 1905, p. 485, fig. 20.

Occurrence. St. WS 84: Falkland Islands, 75–74 m.

DISTRIBUTION. Chile.

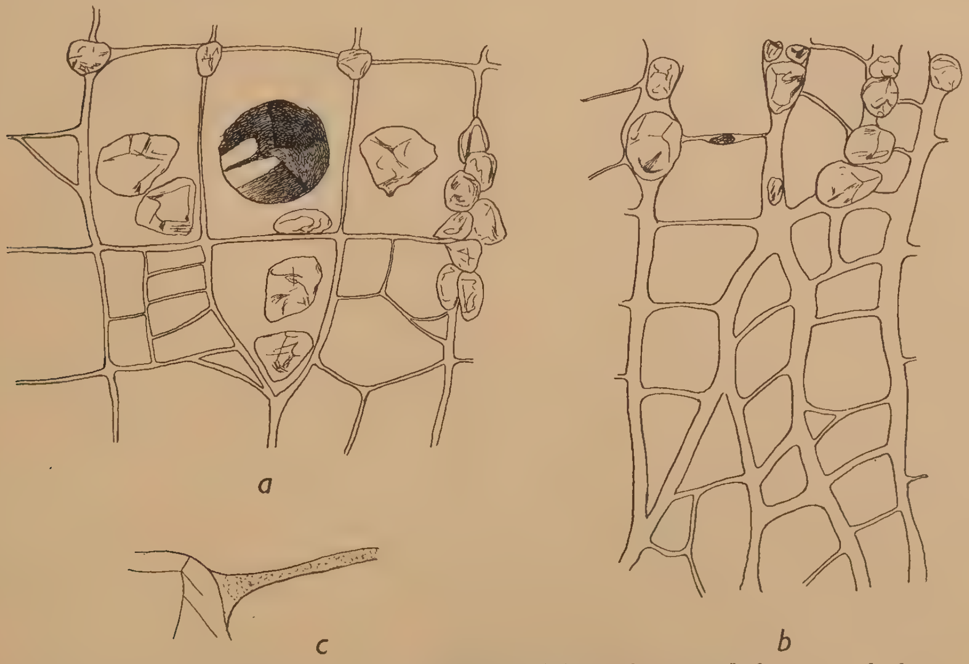

Fig. 41. *Duseideia tenuifibra*, sp.n. *a*, fibres near periphery of sponge; *b*, from near the base; *c*, showing method of attachment of fibres to sand grains.

Duseideia tenuifibra, sp.n. (Plate LVI, fig. 8; Fig. 41).

Holotype. B.M. 28. 2. 15. 840.

Occurrence. St. WS 243: north-east of Falkland Islands, 144–141 m.

DIAGNOSIS. Sponge lobate; surface minutely conulose; oscules 2–4 mm. diameter, situated at or near ends of lobes; texture soft, compressible; colour, in spirit, greyish-green; skeletal fibres very thin, 0·014–0·02 mm. in diameter, forming an irregular network of nearly quadratic mesh, with meshes subdivided by more slender fibres; sand grains not abundant, incorporated in fibres or lying loosely in meshes of skeleton.

REMARKS. The species is characterized by the slenderness of its fibres and by the external form. The manner in which the included sand grains are held together is unusual. Instead of being entirely enclosed by the fibre, the grains are connected together by short strands of spongin the ends of which are attached to the surfaces of the sand grains (see Fig. 41 *c*). Near the base of the sponge, and in the inner parts of the lobes, the fibres are thicker and the meshes of the skeleton reduced in size (cf. Fig. 41 *b*).

Genus **Dendrilla**, Lendenfeld

Dendrilla membranosa (Pallas).

(For synonymy see Burton, 1929, p. 448.)

Occurrence. St. 45: South Georgia, 238–270 m.

DISTRIBUTION. Wilhelm Land; Victoria Land; Graham Land; Australia; Indian Ocean.

THE AFFINITIES OF THE ANTARCTIC SPECIES OF *TEDANIA*, WITH NOTES ON THE DISTRIBUTION OF THE GENUS GENERALLY

Of the six species of *Tedania* recorded on pp. 302–9 five resemble each other so closely that their identification presents an unusual difficulty, but at the same time raises two points of interest. The first of these points concerns the difficulty of classifying these species; and the second concerns the new importance of embryological observations in systematic studies. Nearly 200 specimens of *Tedania* were collected from the sub-Antarctic and Antarctic and at first no satisfactory classification seemed possible. This was largely due to the strong similarity in the shape of their spicules. Certainly, the various specimens differed in many ways and could be divided into five groups on the basis of external form, but even then many intermediates could be found between the typical forms of these five groups. Similarly, each group was characterized by a particular range of spicule size, but here again intermediates could be found. It was, in fact, only when the embryos were studied, and the data so obtained used as a starting-point for the eventual classification, that it became possible to decide on the identification of these specimens.

It is of some importance to emphasize that the close resemblance of all these specimens of *Tedania*, and the fact that they present numerous intermediates would under other circumstances have suggested that all were conspecific, had the embryology not indicated otherwise. In fact, had the characters of the embryos been overlooked, we should have had in *Tedania* a similar position to that presented by Vosmaer (1911) in his study of *Spirastrella purpurea* (Lamarck), and (1932 *et seq.*) in his studies of the Porifera Incalcaria of the Bay of Naples. And while I believe that Vosmaer was mainly correct in his conclusions regarding *S. purpurea* (there are points, of course, where he has obviously gone wrong), it would be better to endeavour to apply the embryological test as far as possible, both to this and all other species. This gives to the study of embryology an importance, hitherto unsuspected, as the deciding criterion in systematic work.

The characters and close relationship of the five species of *Tedania* here recorded are given in the table on p. 308.

In dealing with so large a collection, it was found possible after a while, and once the main distinguishing features were appreciated, to classify specimens with considerable certainty even in the absence of embryos. Nevertheless, so closely are these five species related and interdigitated in regard to their main characters that several specimens could only doubtfully be assigned to a species. Where only a few specimens are found in a collection therefore, it is conceivable that this difficulty will be considerably increased, unless embryos can be found in them.

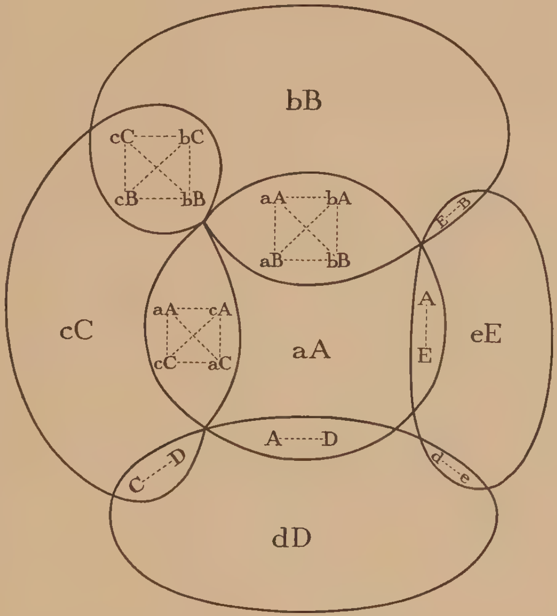

Fig. 42. Diagram showing relationships and overlapping in the Antarctic and sub-Antarctic species of *Tedania*. The five main areas represent types of embryology: *aA*, *T. tenuicapitata*; *bB*, *T. charcoti*; *cC*, *T. massa*; *dD*, *T. spinata*; *eE*, *T. murdochi*. *a–e* represent types of spiculation and *A–D* external forms of these species respectively.

In order to stress the importance of the conclusions reached in this study of the species of *Tedania*, it is considered worth while to express graphically the relationships of these species, so that these may be contrasted and compared with the diagram given by Vosmaer (1911, p. 324) for *Spirastrella purpurea* (Lamarck). Vosmaer shows seven groups representing typical forms of *S. purpurea* and indicates how these are connected by intermediates. From this he concludes that the specimens comprising these groups are all conspecific. In the present case, the corresponding groups are much more closely connected and may be represented, not by detached circles, but by overlapping areas (Fig. 42), and yet the specimens they represent actually belong to different species. For example, in the area where *T. massa* overlaps *T. tenuicapitata* may be included the

Table showing comparison of chief distinguishing features in Antarctic species of Tedania.

Species	External form	Surface	Ectoparasitic amphipods	Oscules	Main skeleton*	Styli†	Tornota‡	Onychaeta§
T. spinata (Ridley)	Flabellate, branching or irregularly massive	Smooth	Abundantly present usually	Small in linear series on margins of flabellate and branching specimens	Rectangular or triangular network, with sides of meshes formed of 2–4 spicules	Smooth or bearing occasional spines near base: 0·165–0·28 × 0·005–0·011 mm.	0·18–0·24 × 0·004–0·007 mm.	0·052 to 0·21 mm., not divided into groups of different sizes
T. tenuicapitata, Ridley	Flabellate or irregularly massive	Thrown into meandrine folds of varying size	Commonly present	Small, scattered	Rectangular or triangular network, with sides of meshes formed of 2–4 spicules	Smooth: 0·35–0·49 × 0·007–0·018 mm.	0·188–0·39 × 0·004–0·012 mm.	0·07–0·18 and 0·28–0·43 mm.
T. murdochi, Topsent	Irregularly massive to massively flabellate	Wrinkled	Absent	Large, conspicuous, on mammiform processes	Rectangular meshes, with ascending fibres obviously stronger than conjunctives	Smooth: 0·21–0·23 × 0·007–0·008 mm.	0·18–0·22 × 0·004–0·005 mm.	0·04–0·21 mm., not divided into groups of different sizes
T. charcoti, Topsent	Massive, often with digitate or flabellate processes, to sub-clathrate	Wrinkled, smooth, or thrown into meandrine folds	Occasionally present	Apparently absent, to large and conspicuous, borne on mammiform processes	Rectangular network, with sides of mesh formed of 2–4 spicules	Smooth: 0·35–0·53 × 0·001–0·03 mm.	0·24–0·39 × 0·007–0·021 mm.	0·08 and 0·29 mm.
T. massa, Ridley and Dendy	Conical (i.e. carrot-shaped) to spherical, massive or flabellate	Even, smooth	Commonly present	Large and arranged in linear series (on flabellate forms) or scattered (on massive forms), to collar-shaped (in conical forms)	Spicules in bundles of 2–5, scattered, seldom forming a coherent network	Smooth, with tendency to become strongylote: 0·44–0·78 × 0·01–0·04 mm.	0·3–0·5 × 0·007–0·012 mm.	0·07–0·28 and 0·4–0·7 mm.

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* The characters given here are typical for the respective species: there is, however, some variation and overlapping.

† In all cases, the typical style is smooth, slightly curved, and ending in an abrupt point at the distal end. In *T. spinata*, the only variation is the presence of occasional spines near the base, but these are not present in every specimen. In *T. massa* the typical form of the style tends to be modified more frequently than in the other species by a rounding off of the distal end.

‡ The shape of the ends of the tornota is very variable, more so in some species than in others, and more particularly in certain individuals. To use this character for purposes of classification would therefore be unsound.

§ Reference has already been made to the unreliability of the onychaeta for purposes of classification. In this column only typical cases are given, the variations being mainly neglected.

discoid specimen, with spicules of small size, which was to all intents a specimen of *T. tenuicapitata*, but which was found to contain embryos typical of *T. massa*. Topsent's (1908, pl. i, fig. 3) *T. charcoti* might be placed in the area where *T. murdochi* and *T. charcoti* overlap. And so on. As will be seen from the diagram, *T. spinata* and *T. tenuicapitata*, *T. massa* and *T. spinata*, and *T. murdochi* and *T. charcoti* can only be confused in external form, and *T. spinata* and *T. murdochi* resemble each other only in spiculation. On the other hand, *T. tenuispiculata*, *T. charcoti* and *T. massa* are subject to considerable confusion.

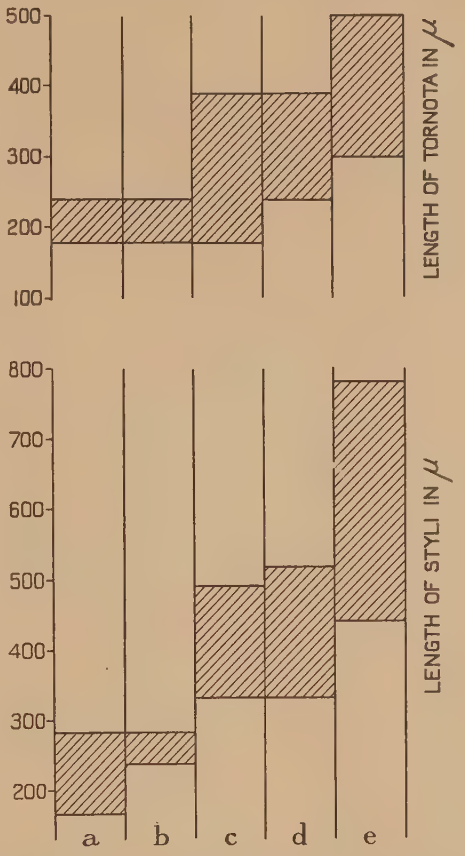

Fig. 43. Showing the relative lengths of the styli and tornota in: *a*, *T. spinata*; *b*, *T. murdochi*; *c*, *T. tenuicapitata*; *d*, *T. charcoti*; *e*, *T. massa*.

The second point raised is that concerning the specialized character of these species as compared with the remaining species of *Tedania*.[1]

Judging from the embryological evidence, and the development of the external form and spiculation, *Tedania nigrescens* (Schmidt) is the most primitive species of the genus, and the Antarctic group, including also *T. mucosa*, Thiele, *T. excavata*, Thiele, *T. pectinicola*, Thiele, *T. fuegiensis*, Thiele, and *T. infundibuliformis*, Ridley and Dendy, is the most specialized. And of these, the species found in the Antarctic (*sensu stricto*) are the most highly specialized of all. Thus, in *T. oxeata* the styli are replaced by pseudoxea (cf. the life history of *Iophon radiatus*, Topsent (Burton, 1931, p. 514, fig. 2*e*)); *T. charcoti* shows a higher degree of development than the others, since the fully-developed embryonic spicules are styli; but in *T. massa* is found the most convincing proof that the Antarctic species are more specialized than the non-Antarctic. In

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[1] The section Tedanieae, of the Desmacidonidae, consists at present of the genera *Tedania*, Gray; *Trachytedania*, Ridley; *Tedaniopsis*, Dendy; *Paratedania*, Burton; *Tedaniella*, Czerniavsky; and *Tedanione*, Wilson. As shown on p. 306, *Trachytedania* must be regarded merely as representing the post-larval stage of *Tedania spinata* (Ridley) and perhaps others. Further, *Tedaniopsis* and *Paratedania* are clearly synonyms and, as shown on p. 306, the genotype of the latter is synonymous with *Tedania massa*, Ridley and Dendy. *Tedanione*, on the other hand, appears to be synonymous with *Rhaphoxya*, one of the Axinellidae, and *Tedaniella*, inadequately characterized, may be a synonym of *Petrosia*.

The species of *Tedania*, as here understood, appear to number 24: *T. bispinata*, Hentschel; *T. charcoti*, Topsent; *T. commixta*, Ridley and Dendy; *T.* (*Tedanione*) *connectens* (Brøndsted); *T. coralliophila*, Thiele (with *T. brevispiculata*, Thiele; *T. maeandrica*, Thiele; and *T. reticulata*, Thiele, as probable synonyms); *T. diraphis*, Hentschel; *T. diversirhaphidiophora*, Brøndsted; *T. excavata*, Thiele; *T. fragilis*, Lambe; *T. fuegiensis*, Thiele; *T. infundibuliformis*, Ridley and Dendy; *T. massa*, Ridley and Dendy; *T. mucosa*, Thiele; *T. murdochi*, Topsent; *T. nigrescens* (Schmidt) (see Burton and Rao, 1932, p. 353, for full synonymy);

this species the form varies from massive or flabellate, to the highly specialized form which I have called "carrot-shaped" (cf. fig. 25 *d*, p. 304). The specimens of this species in the present collection, classified as follows, show how this specialization is increased as the Antarctic continent is approached:

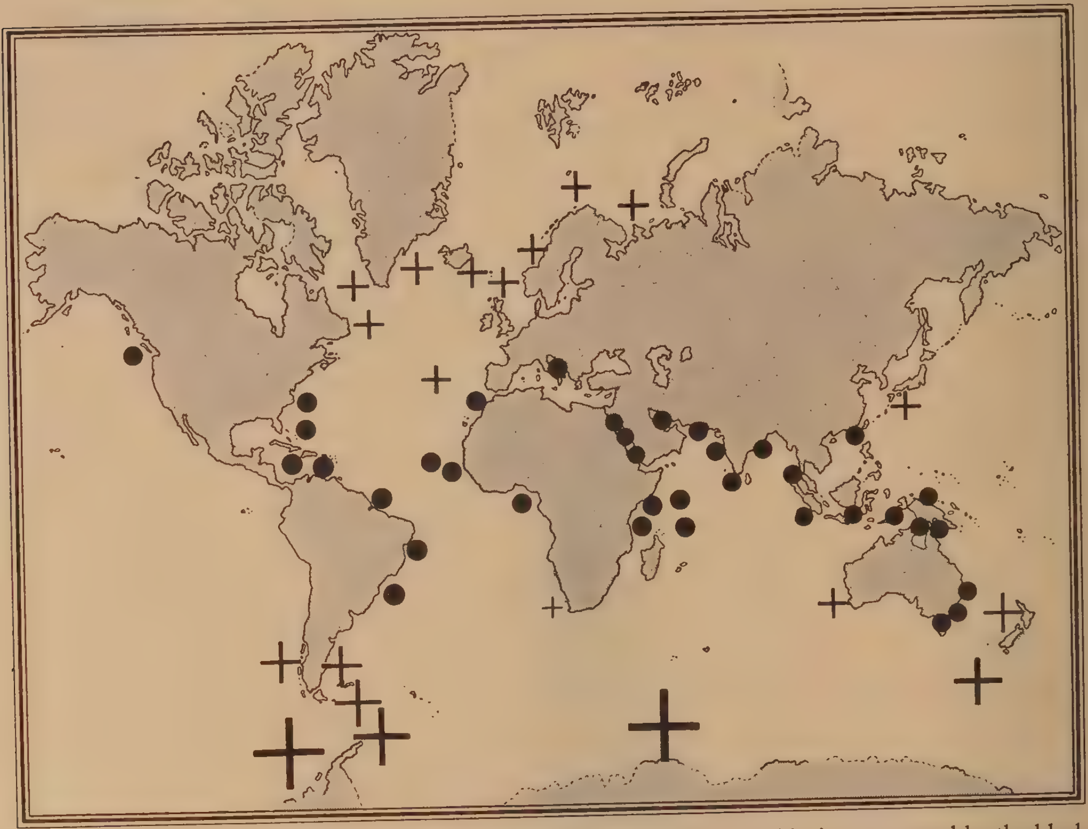

Fig. 44. Plan of distribution of the species of *Tedania*. *T. nigrescens*, Schmidt, is represented by the black dots, the remaining species by crosses. The size of the crosses is proportionate to the degree of specialization attained by the species they represent.

Locality	Massive to flabellate (primitive)	"Carrot-shaped" (specialized)
Falkland Islands	20	1
South Georgia	4	4
Antarctic continent	—	20

T. oxeata, Topsent; *T. pectinicola*, Thiele; *T. phacellina*, Topsent; *T. placentaeformis*, Brøndsted; *T. scotiae*, Stephens; *T. suctoria*, Schmidt (with *T. increscens*, Schmidt, and *T. conuligera*, Topsent, as synonyms); *T. tenuicapitata*, Ridley and Dendy; *T.* (*Tedanione*) *wilsoni* (Dendy); and *T.* (*Tedaniopsis*) *turbinata* (Dendy).

[The following must be removed from the genus *Tedania*: *T. crista-galli*, Dendy, to Axinellidae; *T. coulmani*, Kirkpatrick, to *Kirkpatrickia*; *T. variolosa*, Kirkpatrick, to *Kirkpatrickia*; *T. laevis*, Kirkpatrick, to ? Plocamicae; *T. laxa*, Lendenfeld, to *Stylotella agminata*, Ridley; *T. tenuispina*, Lendenfeld, to *Stylotella agminata*, Ridley; *T. leptoderma*, Topsent, to *Lissodendoryx isodictyalis*, Carter.]

The picture presented by the distribution of these species (Figs. 44, 45) is thus a very interesting one. We have one species, *T. nigrescens* (Schmidt), the least specialized of the genus, variable in form, having a wide distribution, and all round the margins of its area of distribution are found species of slightly more advanced development and greatly restricted distribution. The culmination is found in the sub-Antarctic and Antarctic species which appear to show a continued progression in development as the Antarctic is approached, until, within the Antarctic itself, we have the three most specialized species of all, *T. charcoti*, *T. massa* and *T. oxeata*. This picture, in fact, suggests the possibility that this variable species, fluctuating considerably in its main characters, has given rise to a number of localized and more highly developed species at various points; and that from these have arisen other species with, generally, an increasingly higher degree of specialization as the polar waters are approached.

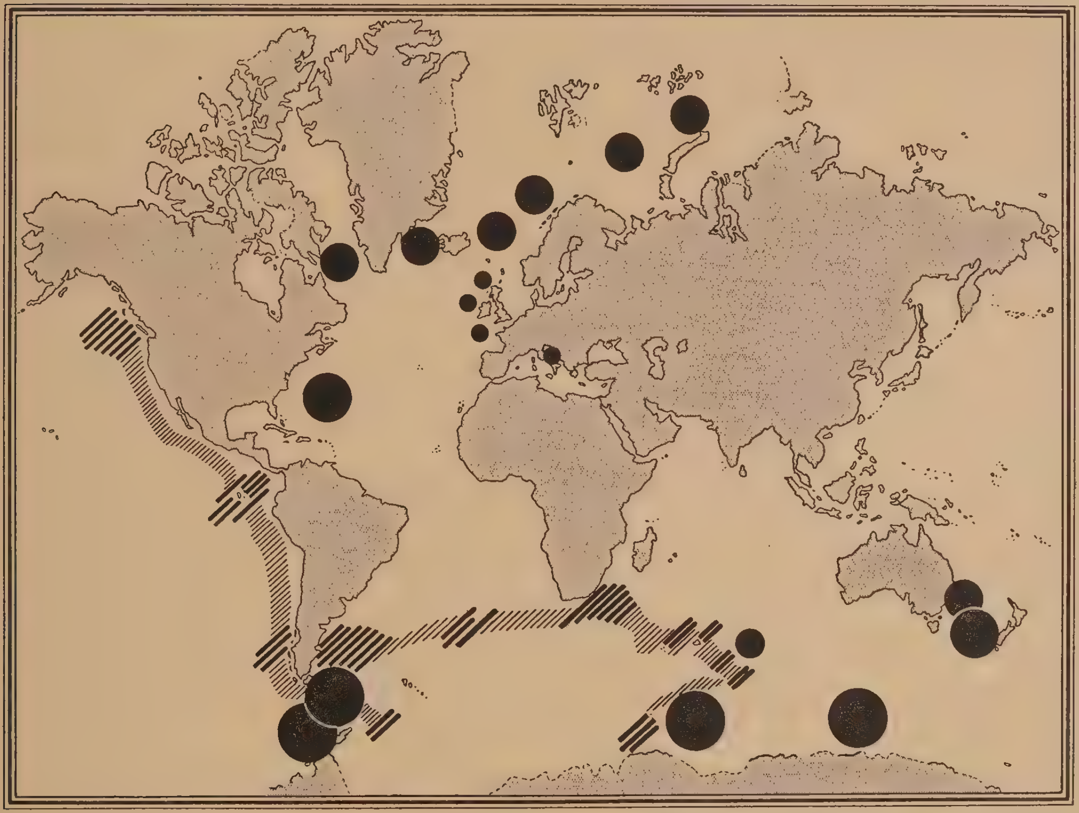

Fig. 45. Plan of distribution of the species of *Iophon*. The shaded area represents the distribution of *I. proximum*, Ridley, the darker lines coinciding with localities at which the species has been actually recorded, the thin lines where it may be assumed to occur. The size of the black dots, representing the remaining species of the genus, are proportionate in size to the degree of specialization of the species.

THE EVOLUTION OF THE SPECIES OF *IOPHON*, AND ITS SIGNIFICANCE IN RELATION TO OTHER ANTARCTIC SPECIES OF ECTYONINAE

The genus *Iophon* provides another striking plan of the distribution of species and, in addition, a probable indication as to the generation of species. In the North Atlantic, restricted to the coasts of the Mediterranean, and of Western Europe as far north as the British Isles, are two species, closely allied and apparently the most primitive of the genus. These are *I. pattersoni* (Bowerbank) and *I. hyndmani* (Bowerbank). It is a remarkable fact that these two species are almost invariably found growing in association. That is to say, if, in a single haul of the dredge, examples of one species are obtained, examples of the second will almost certainly be present also. There is yet a third species, *I. scandens* (Bowerbank), of rare occurrence, the characters of which are intermediate between those of the other two species. It appears probable that future research may show either: (i) that these three species represent different growth stages of a single species; (ii) that *I. pattersoni* and *I. hyndmani* are forms of a single dimorphic species, and *I. scandens* an occasional intermediate; or (iii) that *I. pattersoni* and *I. hyndmani* are distinct species, and possibly *I. scandens* a hybrid. At all events, it will be convenient to regard them here as representing a single primitive species.

The remaining six species of the genus are all more specialized than the foregoing in many respects, especially in their external form and in the shape of the bipocilla. The first of these is *I. piceus*[1] (Vosmaer), found on the coasts of Norway and in the Arctic. The second is *I. proximum* (Ridley), which is found throughout the sub-Antarctic, from Kerguelen (and Natal) to South America, up the western coast of South America to the Galapagos, on the western coast of North America and possibly round to the eastern coast of Canada. In addition, it is found rarely in the Antarctic. The third species, *I. laminalis*, Ridley and Dendy, from Prince Edward Island, is closely related to, if not synonymous with, *I. proximum*. The fourth, *I. omnivorus*, Ridley and Dendy, from Australia, is slightly degenerate, though still somewhat more specialized. The fifth, *I. laevistylus*,[2] from New Zealand, is more specialized. The sixth, *I. melanokhemia* (de Laubenfels) from Puget Sound, is probably also a specialized offshoot from *I. proximum*. The last, and most specialized, *I. radiatus*, Topsent, though also found in the Falkland Islands area of the sub-Antarctic, is most numerous in the Antarctic proper. This species, in its development, passes at first through a stage recalling the *hyndmani-pattersoni* group, and, later, shows certain features associated with *I. proximum*.

The picture (Fig. 45) presented by these species may be summarized as follows. The group represented by *I. hyndmani* and *I. pattersoni* is a primitive one, and from it, to the north, a more specialized species has sprung (*I. piceus*). To the south, it has given rise to *I. proximum*, again a slightly more specialized species, but one in a state of extreme fluctuation as regards its spicular characters (cf. Figs. 22–24). From this variable species have arisen several more specialized species, which have migrated in a southerly direction: *I. laminalis* in the Southern Ocean, *I. omnivorus* in Australia, *I. laevistylus* in New Zealand, and *I. radiatus* in the Antarctic. At the northern limit of its range of distribution, it has possibly given rise to another specialized species, *I. melanokhemia*.

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[1] There can be little doubt, in view of the variability of the spicules found in *I. radiatus* and *I. proximum*, that *I. piceus*, Vosmaer, *I. frigidus* (Levinsen) and *I. dubius* (Hausen) are conspecific; especially as they are so alike in external form.

[2] *Iophon major* and var. *tenuis*, Brøndsted, and *I. minor*, Brøndsted, are quite evidently conspecific with *I. laevistylus*, Dendy, in view of what is now known concerning the variations in all species of *Iophon*.

We have here an indication that the species of *Iophon* have developed from a form the prototype of which is located in the North Atlantic, and that its most specialized species is found in the Antarctic. The same thing may be said of the species of *Mycale*. In point of numbers, the species of the North Atlantic (i.e. on the European side) are the most numerous. Elsewhere the species of this genus are found mainly in the Antarctic and sub-Antarctic, and in the Indo-Australian area; but whereas the Indo-Australian species are either little more specialized than those of the North Atlantic, or, more commonly, degenerate (cf. *Arenochalina mirabilis*, Lendenfeld, from Australia, a degenerate *Mycale*), the Antarctic species are somewhat more specialized than any of the rest. Moreover it may be noted that the six Antarctic species of *Mycale* are found in localities bordering on the area of distribution of *M. magellanica* (Ridley), a species comparable with *Iophon proximum* (Ridley) in the variability of its spiculation. Finally, we find that the two most specialized species of *Mycale*, *M. intermedia*, Schmidt, and *M. acerata*, Kirkpatrick, are found in the Arctic and Antarctic respectively.

The distribution of the genus *Amphilectus* is also similar to that of *Iophon* and *Mycale*. The least specialized and most variable species, *Amphilectus fucorum* (Johnston), is distributed generally around the European coasts and in the Arctic, is found on the west coast of Africa, around the southern extremity of South America, in the Antarctic, and finally at New Zealand. Again we find specialized species, *A. quatsinoensis* (Lambe), on the west coast of Canada, and *A. americana* (Ridley and Dendy) around the southern extremity of South America. In addition, there are *Corybas lobata* (Johnston) in the North Atlantic and Arctic, and *Brondstedia glaber* (Brøndsted) in the Antarctic, both of which must be regarded as species closely related to *Amphilectus fucorum* but slightly more specialized.

The genus *Isodictya* is confined practically to the Arctic, European coasts, south coast of Africa, southern extremity of South America, the Antarctic and New Zealand. And again we find the most primitive species in European waters, while around South Africa the species of this genus show a rich development in numbers of species, size of individuals and growth of spicules. This progressive tendency in the South African species of *Isodictya* is carried still farther in the sub-Antarctic and Antarctic, where the genus reaches its highest degree of development.

There is in this a striking parallel which cannot be ignored, and which suggests that four of the most primitive sections of the Desmacidonidae—the Isodictyeae, the Mycaleae, the Tedanieae and the Iophoneae—have each arisen in an area approximating to the European side of the North Atlantic, and from thence have spread northwards to the

Arctic in one direction, and southwards to the Antarctic, along the west coast of Africa, in the other, with a lateral path of migration extending into the Indian Ocean. The remaining sections of the Desmacidonidae, the Myxilleae and Clathrieae, are world-wide in distribution; but here again the more primitive species are found in the North Atlantic, and so far as the Myxilleae are concerned, the more highly developed species are found in the sub-Antarctic and Antarctic.

Nor can we ignore the coincidence that the widely distributed and primitive species *Iophon proximum*, *Tedania nigrescens* and *Amphilectus fucorum*, with a very variable spiculation or external form, have a number of more highly developed species, which appear to have developed from them, around the fringes of their areas of distribution.

With the line of progression from Europe to the Antarctic, down the west coast of Africa, shown by the species of *Isodictya*, *Amphilectus*, *Mycale*, *Iophon* and *Tedania*, may possibly be correlated the curious, discontinuous distribution shown by the species of *Plakina* (*P. monolopha*, *P. dilopha*, and *P. trilopha*, together with several others) which are found only in the Mediterranean and the Antarctic. The full significance of this cannot yet be assessed, but it is a matter which should not be overlooked. How this particular distribution has been effected is a question which raises numerous difficulties.

Brøndsted (1926) has suggested that the distribution of New Zealand sponges may be best explained on the Wegener hypothesis; but whereas, in some parts of the world, the Wegener hypothesis will explain the distribution of sponges as well as any other hypothesis yet put forward, it is entirely insufficient in dealing with the sponges of the Atlantic Ocean. The main features of the distribution of sponges in this area are on the whole contrary to what might be expected on the Wegener hypothesis. They are as follows:

(1) The dissimilarity of the fauna of the eastern coast of the United States of America and that of Europe.

(2) The similarity between the fauna of the West Indies and that of the Indo-Australian area.

(3) The existence of species common to the European and West African coasts, the sub-Antarctic (as represented by the Falkland Islands area) and the Antarctic, and their absence elsewhere in the Atlantic.

(4) The presence in the Antarctic of several species found hitherto only in the Mediterranean.

Nor can the "creeping" of species around the coasts explain more than a small proportion of the facts of distribution of species. I have already suggested (1930) a correlation between the main surface currents of the ocean and the distribution of sponges in the North Atlantic, and it is now proposed to show that a similar correlation exists in the South Atlantic and Indian Oceans.

GEOGRAPHICAL DISTRIBUTION

In the following Table, which represents the distribution of species in the Antarctic and sub-Antarctic and in the adjacent areas, no mention is made of species newly described in this report, of cosmopolitan or widely distributed species, or of species with a limited distribution. The sole purpose of the Table is to indicate approximately the relations between the various localities, indicated at the head of the Table, in so far as their respective sponge faunas are concerned.

	Antarctic (Victoria Land, Wilhelm Land, etc.)	Graham Land (including Palmer Arch., S. Shetlands and Elephant Group)	S. Orkneys	S. Georgia (including Shag Rock)	Falkland Islands (including Burdwood Bank)	S. America (Chile, Patagonia, Tierra del Fuego)	Tristan da Cunha and Gough Island	Kerguelen Area	Campbell Island	Further Distribution
Rossella antarctica, var. *intermedia*	...	×	...	×						
R. nuda	×	×	...	×	×					
R. racovitzae	×	×	...	×	×					
R. villosa	×	×								
Gymnorossella inermis	...	×	...	...	×					
Leucosolenia discovereyi	×	...	...	...	×					
Leucetta leptoraphis	×	×	...	...	×					
L. macquariensis	...	...	...	×	×	...	...	...	...	Macquarie I.
Leucettusa haeckeliana	...	...	...	...	×	...	...	×		
Grantia cirrata, var. *aurorae*	×	...	...	×	×					
Plakina trilopha	×	×	...	×	×	...	...	...	...	Mediterranean
Geodia magellani	...	...	...	...	×	×				
Tetilla leptoderma	×	×	...	×	×	×	...	×		
Cinachyra antarctica	×	×	...	×						
C. barbata	×	×	...	×	×	...	...	×		
C. coactifera	...	...	...	×	...	...	...	×		
Haliclona nodosa	...	...	...	×	...	×				
H. chilensis	...	...	...	...	×	×				
H. variabilis	...	...	...	...	×	×				
H. penicillata	×	×	...	...	×					
H. gaussiana	×	...	...	×						
H. tubuloramosa	...	...	...	...	×	...	...	...	...	New Zealand
H. conica	...	...	...	...	×	...	...	...	...	New Zealand
Microxina benedeni	×	×	...	×	×					
Hemigellius rudis	×	×	...	×						
Adocia carduus	...	×	...	×	×	×	...	×		
A. glacialis	...	×	...	×	...	×	...	×		

	Antarctic (Victoria Land, Wilhelm Land, etc.)	Graham Land (including Palmer Arch., S. Shetlands and Elephant Group)	S. Orkneys	S. Georgia (including Shag Rock)	Falkland Islands (including Burdwood Bank)	S. America (Chile, Patagonia, Tierra del Fuego)	Tristan da Cunha and Gough Island	Kerguelen Area	Campbell Island	Further Distribution
Adocia siphonella	...	...	...	...	...	×	×			
A. cucurbitiformis	×	×								
Calyx arcuarius	×	×	×	×						
C. kerguelensis	...	...	×	×	...	...	...	×		
Dasychalina validissima	...	...	...	×	×	×				
Callyspongia fortis	...	...	...	...	×	×				
C. fusifera	...	...	...	...	×	×				
Isodictya kerguelensis	...	×	...	...	×	...	...	×		
I. kerguelensis, var. *simillima*	×	...	...	...	×					
I. setifera	×	×	...	×	×					
I. delicata	...	...	...	...	×	×				
I. antarctica	×	...	...	×	×					
I. cactoides	×	×	...	×						
I. erinacea	×	×								
Cercidochela lankesteri	×	×								
Plumocolumella maeandrina	×	...	...	×						
Mycale magellanica	×	×	...	×	×	×				
M. lapidiformis	...	...	...	...	×	×				
M. acerata	×	×	×	×						
M. tridens	×	×	...	×						
Amphilectus rugosus	×	...	...	...	×	×	×			
Biemna chilensis	×	×	...	...	×	×				
Asbestopluma calyx	×	...	...	×						
Acanthorhabdus fragilis	×	×								
Iophon radiatus	×	×	...	×						
I. proximum	...	...	...	×	×	×	×	×	...	Galapagos I., Canada
Tedania tenuicapitata	×	×	...	×	×	×				
T. oxeata	×	×								
T. massa	×	×	...	×	×					
Myxilla mollis	×	×	...	×	×	×				
M. asigmata	×	×	...	×						
M. chilensis	...	...	...	...	×	×				
M. elongata	×	...	...	×						
Ectyodoryx paupertas, subsp. *nobile*	...	...	...	×	×	×	...	×		
E. antarctica	×	...	...	×						
E. frondosa	×	×								
E. ramilobosa	×	×	...	×						
Anchinoë latrunculioides	×	×	...	×	×	×	...	...	...	South Africa
A. areolata	×	...	...	×	...	×				
A. leptochela	×	...	...	×						
Kirkpatrickia variolosa	×	×	...	×						

	Antarctic (Victoria Land, Wilhelm Land, etc.)	Graham Land (including Palmer Arch., S. Shetlands and Elephant Group)	S. Orkneys	S. Georgia (including Shag Rock)	Falkland Islands (including Burdwood Bank)	S. America (Chile, Patagonia, Tierra del Fuego)	Tristan da Cunha and Gough Island	Kerguelen Area	Campbell Island	Further Distribution
Kirkpatrickia coulmani	×	...	...	×						
Inflatella belli	×	...	...	...	×	...	...	...	...	New Zealand
Plocamia gaussiana	×	×	...	×						
Clathria papillosa	...	...	...	...	×	×				
C. toxipraedita	...	×	...	×	×					
Ophlitaspongia membranacea	...	×	...	...	...	×				
Artemisina apollinis	×	×	...	×	...	...	...	×	...	North Atlantic
A. plumosa	×	...	...	...	×					
Dictyociona discreta	...	...	...	...	×	×	×			
Axociella nidificata	×	×	...	×						
A. flabellata	×	×	...	×						
Pseudanchinoë toxifera	×	×	...	×	...	...	×			
Eurypon miniaceum	...	×	...	×	...	×	...	...	...	South Africa
Stylotellopsis amabilis	...	...	...	×	×	×				
Hymedesmia irritans	...	...	...	...	...	×	×			
H. laevis	...	...	...	...	×	×				
H. simillima, var. *antarctica*	×	...	×	...	×					
Crella crassa	×	×								
Crellina tubifex	×	×								
Hymeniacidon fernandezi	...	...	×	×	×	×				
H. torquata	...	×	...	...	...	...	×			
Thieleia rubiginosa	...	...	...	×	...	×				
Axinella crinita	...	...	...	...	×	×				
Pseudaxinella egregia	...	...	...	...	...	×	×			
Homaxinella supratumescens	×	×	...	×						
Rhizaxinella australiensis	×	×	...	...	...	...	...	...	...	Australia
Suberites montiniger	×	...	...	...	×					
S. microstomus, var. *stellatus*	×	×	...	...	×					
S. papillatus	×	×	...	...	×					
Pseudosuberites hyalinus	×	×	...	×	...	×	×	...	...	Europe
P. sulcatus	×	...	...	×	×	×	×	...	×	
Polymastia isidis	×	×	...	...	×					
P. invaginata	×	×	×	×						
Sphaerotylus antarcticus	×	×								
Stylocordyla borealis, subsp. *acuata*	×	×	×	×						
Latrunculia lendenfeldi	×	...	...	...	×					
Halisarca dujardini, var. *magellanica*	×	×	...	...	×	×				
Spongia magellanica	...	...	...	×	...	×				
Dendrilla membranosa	×	×	...	×	...	...	...	...	...	Australia; Indian Ocean

The following analysis may be made from the table:

Of the 69 Antarctic species:

50 are found also off Graham Land.
43 " South Georgia.
29 " Falkland Islands.
11 " South America.
7 " Kerguelen.

Of the 56 species from Graham Land:

50 are found also in the Antarctic.
32 " off South Georgia.
23 " Falkland Islands.
11 " South America.
5 " Kerguelen.

Of the 57 species from South Georgia:

43 are found also in the Antarctic.
32 " off Graham Land.
19 " Falkland Islands.
13 " South America.
8 " Kerguelen.

Of the 51 species from Falkland Islands:

29 are found also in the Antarctic.
23 " off Graham Land.
19 " South Georgia.
24 " South America.
6 " Kerguelen.

The list showing the species recorded from each station gives a clear insight into the distribution of species within the Antarctic and sub-Antarctic zones. Taken in conjunction with my table of Antarctic species (1929, pp. 394–401), there appears to be no really marked change in the fauna at Graham Land, where the species are dominantly Antarctic. The same is true for the South Shetlands; but at South Georgia there are, in addition to numerous Antarctic species, a number common to that locality and the Falkland Islands, and a few common to it and the mainland of South America. Around the Falkland Islands there are still many Antarctic species to be found; but the character of the sponge fauna is more that of the southern regions of the South American continent (e.g. Patagonia and Chile). One Antarctic and South American species is also recorded with this report (see p. 325) from the False Bay region of South Africa.

Taking the records contained in this report in conjunction with my previous papers (1929, Terra Nova Report, and 1930, Senckenbergiana) it becomes evident that there is no real distinction to be made, so far as sponges are concerned, between the faunas of the Antarctic or sub-Antarctic, nor is there any marked difference in the Magellan and Kerguelen regions (cf. Regan, 1914, Vol. 1, *British Antarctic 'Terra Nova' Exped. Rep.*). It appears, on the contrary, that there is a gradual diminution in the Antarctic species as we travel outwards from the Antarctic Continent. There are, however, several significant features of the distribution, which have an important bearing on the general problem of the distribution of species in the South Atlantic. These are: (i) that one species of Antarctic and one South American species are found around False Bay; and (ii) that on the eastern shore of the South American Continent some Antarctic species appear to have penetrated as far north as the mouth of the Rio de la Plata, but that beyond this the character of the fauna changes entirely. To understand the full significance of this it is necessary to consider the distribution of sponges in the South Atlantic in conjunction with that in the Indian Ocean.

In his monograph of the horny sponges (1889), von Lendenfeld refers to a number of species of Euceratose sponges as being common to both Australia and the West Indies, and found only in those two areas. At first sight it seems unlikely that a species should be restricted to two such widely separated areas, and unfortunately this author leaves no record as to where the material on which he worked may be found, so that it is not possible to verify his results by actual observation. Since, however, so many of his identifications have been shown to be inaccurate, his conclusions are apt to be regarded as unreliable. Moreover, the extreme difficulty of identifying species of the Euceratosa with certainty only serves to increase the doubt felt on this point. Recent observations have tended, however, to suggest that von Lendenfeld may have been correct in this case. For example, the single commercial sponge found on the Great Barrier Reef of Australia seems to be indistinguishable from some of the varieties of the Bahamas grass sponge, and is, so far as I am aware, not found elsewhere unless it be in the adjacent waters of the Indo-Pacific. The question remains therefore whether the superficial resemblance between the Barrier Reef sponge and the West Indian grass sponge may not be the result of convergence rather than of actual affinity. That this is no case of convergence, and that the two have a common origin, is suggested by the fact that at least five species of sponge, sufficiently well characterized to be identified without hesitation, are common to both the West Indies and Australia. Moreover, in some cases they have been found also in the Indian Ocean and on the west coast of Africa. This seems to have an important bearing on the problems concerning the distribution of sponges and on the systematic study of the group.

I have suggested (1930) that there might be some correlation between the distribution of sponges and the main surface currents of the oceans, and that the study of these currents might be of material benefit in interpreting the natural and well-marked areas of distribution which undoubtedly exist. This arose from the study of the sponge fauna of Norway, but the conclusions reached then concerning the North Atlantic appear to hold true for the South Atlantic also. Assuming this to be the case, the chart of the main oceanic currents is not only sufficient to show why the faunas of the Red Sea, Indian Ocean and Indo-Pacific differ little from each other, but also why that of the Barrier Reef of Australia should be composed almost exclusively of species belonging to those areas. This well-defined area of distribution, the Indian Ocean and Indo-Pacific area, ends abruptly in the west in the region of the Agulhas current. On the west and north it is bounded by the continents of Africa and Asia respectively, and in the south by the cold waters of the West Wind Drift, which is to all intents an impassable barrier to migration. The eastern boundary must be ignored for the present, as our knowledge of the sponges of the Pacific is so imperfect, and to avoid unnecessary complications the sponge fauna of Australia, exclusive of the Barrier Reef, must be left out of the reckoning. The area thus delimited, which for the sake of brevity may be called the Indian Ocean area, in addition to constituting a natural and well-marked faunal area, forms a closed system of circulatory currents, and it is easy to imagine that these two conditions are correlative. In the same way, that portion of the Atlantic south of a line approximating to the Equator constitutes a second well-defined area and forms also a partially closed system of circulatory currents. To the east and west it is bounded by the continents of Africa and America and to the south, again, by the waters of the West Wind Drift. To the north is a similar faunal area, with its circulatory system, with which the South Atlantic system is put into communication mainly by the Gulf Stream; and such species as are common to both North and South Atlantic follow a line of distribution which accords with the conclusions outlined in the paper already referred to. For the moment, then, it will be convenient to ignore the North Atlantic system.

We have thus two closed systems of currents, each with its well-defined fauna, and if we are to accept the hypothesis that the distribution of sponges is effected by surface currents, we should expect to find a complete absence of species common to the two areas. This is, as a general rule, true. A few species, not more than 2 per cent, have, however, migrated from the Indian Ocean to the South Atlantic; but these exceptions are apparent only and serve to test the rule, since having once gained entrance into the South Atlantic system, their distribution again follows the line of the main surface currents. On the other hand, and this at first sight seems to be a much greater obstacle to the development of the argument, while there is this migration from the Indian Ocean to the South Atlantic, there is no evidence of a similar migration from the South Atlantic to the South Pacific. This is the more remarkable since the gateway from the Indian Ocean to the South Atlantic and that from the South Atlantic to the South Pacific are so similar in character, both being barred by the meeting of a hot and a cold current, with a considerable difference in temperature between the two. When we come to look more deeply into the matter, however, we find that it is on the theory that the major factor in migration is transportation by currents, rather than the limiting effects of temperature, that this apparent anomaly can be explained.

The barrier between the Indian Ocean and the South Atlantic is situated along a line approximately due south of the Cape of Good Hope, and lies along the junction of the Benguela current passing northwards and the Agulhas current flowing southwards. The general faunas east and west of this line are markedly different, and this is almost certainly due to an abrupt drop in temperature in passing from the one current to the other; but the fact that some species do pass this line shows that the barrier is not complete. The second barrier, that between the South Atlantic and the South Pacific, is situated at a line approximately level with Buenos Aires on the South American coast and passes in a south-easterly direction to the region of the West Wind Drift. It is formed by the junction of the Brazil current running down from the north and a cold current flowing up from the region of the Magellan Straits. Here again there is a considerable difference in temperature between the two currents, nearly twice as great as that between the South African currents, and the fact that no South Atlantic species pass this barrier might be taken to mean that temperature was the deciding factor. But to my mind, a more important factor than temperature is the relation of the currents forming the two barriers, namely, that in the South African barrier the currents run parallel with each other, and though in opposite directions, are not opposed, while in the South American barrier they are opposed. In the first case, the mixing of the waters at the line of junction allows the migrating sponges to be carried from the southerly directed Agulhas current into the northerly flowing Benguela current, and thence shortly to be restored to a third current, the South Equatorial, in which the temperature is similar to that of the Indian Ocean currents, whence they have come. Once in the South Equatorial current, their passage to the West Indies and the coast of Brazil is only a matter of time, and we do, in fact, find that one at least of the species common to the West Indies and Australia is also found on the coast of Brazil.

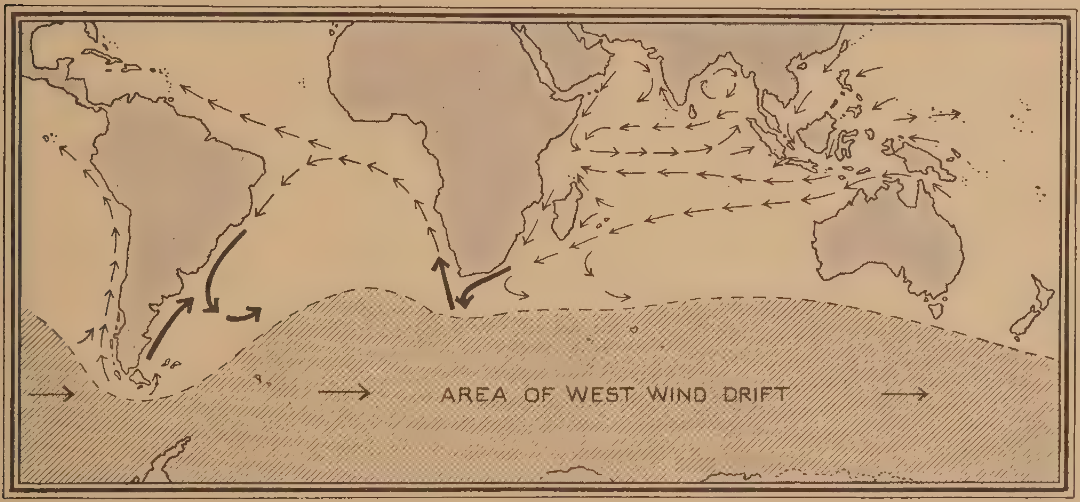


Fig. 46. Illustrating the two closed circulatory systems of currents in the southern hemisphere, in relation to the distribution of sponges in that area.

Assuming that the distribution of sponges is the result of transport by ocean currents, we should expect to find that the fauna north of Buenos Aires differs markedly from the fauna south of that line, and so far as our limited knowledge of these regions can show, this is actually the case. Unfortunately, we know very little of the faunas of these two regions, and future research may conceivably prove the contrary, but from a rapid examination made recently of a collection extending over these two areas this does not appear to be probable. What actually happens to make the South American barrier more effective than that of South Africa is, I imagine, that, since the currents are opposed, any mixing that may take place is nullified by the fact that the cold current from the south encounters and passes under the Brazil current, continuing its journey northwards beneath the surface. In this way, any floating bodies reaching the northern current will be restored once again to the warm surface waters of the South Atlantic.

While it is true that many details have yet to be considered and the hypothesis tested in other parts of the globe, it is reasonable to infer from the evidence afforded by the sponges common to the West Indies and Brazil, on the one hand, and to Australia, on the other, that while temperature does exercise considerable influence, their distribution will probably be found also to be correlated largely with ocean currents.

Theoretically, there is one great objection to this idea; that is the short duration of the larval period, and it was this objection that doubtless gave rise to the view hitherto held that extension of the range of distribution in sponges must always be explained by a slow creeping action round the margins of the land masses or along the sea-bottom, and that where a shallow-water species is represented in two areas widely separated by water, the land masses of these areas must at some time in the earth's history have been closely adjacent or actually connected. The free-swimming larval period of a sponge is normally 24 hours or less. Under abnormal conditions, as in marine aquaria, it may be extended to 2 or even 3 weeks, but this is exceptional and, owing to technical difficulties, it is not known whether such a larva will develop into a normal adult or not. The probability is that it does not. For all practical purposes, therefore, we must assume that the larval period is short, and that trans-oceanic migration on the part of the larva is either normally impossible or, if possible, that successful metamorphosis sufficient to establish the species cannot be accomplished at the end of the journey. On the other hand, it is not impossible that transport is effected after metamorphosis, and that young recently-metamorphosed individuals may be carried by floating objects. In this respect it is pertinent that the young sponge grows very little indeed for several weeks after metamorphosis, remaining usually as a thin inconspicuous incrustation, and in this condition it would not only escape observation but could be carried on floating fragments of such size and of such a nature as to be overlooked.

It is interesting to note that the species involved in this apparent migration from Australia to the West Indies belong to two groups only, the order Euceratosa and to the family Clavulidae of the order Tetraxonida. Whether it is that the larvae of these two groups have certain habits and characteristics which fit them for such migration, or whether the adult individuals are more adaptable and can become established in areas where individuals of other species, carried thither by the same migratory sequence, will perish, is a matter for future research. The important point is that some species of sponges appear to be capable of transportation over long stretches of oceanic waters by the medium of the prevailing currents.

The distance from Australia to the West Indies is very great, and from the presence of species of commercial sponges on the Barrier Reef of Australia identical with, or resembling extremely closely, sponges growing in the West Indies, we can only infer either that their superficial resemblance is due to convergence, which is improbable, or that the possible range of migration, of some species at least, is far greater than has been hitherto believed possible; or, and this is the most probable, that these sponges have also become established in favourable areas, perhaps extremely localized, in the Indian Ocean and the South Atlantic, which have not so far been recorded in the scientific literature. This is, to some extent, borne out by the record (St. 1, p. 340) of *Spongia officinalis*, Linnaeus, from Ascension Island.

EMBRYONIC DEVELOPMENT AND BREEDING SEASONS

It is probable that too little attention has been paid in the past to the value of describing embryos found in preserved material. From a purely embryological point of view such data as may be obtained from them is insufficient, but to the systematist the knowledge gained may be of immense value. Sections cut for purposes of identification may not ordinarily reveal the presence of embryos, which are often situated in the deeper parts of the sponge. For example, hand sections made from a specimen of *Tedania tenuicapitata*, Ridley, in the present collection, revealed no trace of embryos, but these were found in large numbers when the specimen was cut in two. Wherever practicable examination should therefore be made for embryos and their state of development and other cognate information recorded.

EMBRYONIC DEVELOPMENT

Since most information has been obtained regarding the development of the Antarctic species of *Tedania*, as compared with species of other genera, it will be convenient to deal with these first. Numerous embryos were found in some twenty or thirty of the specimens of *Tedania* examined and from these a fairly complete record of development in this group of species may be obtained. In most cases, the embryos present in a given specimen represent only a limited part of the developmental sequence; but in a specimen of *T. charcoti*, Topsent, the whole sequence can be followed in a few hand sections, from the unsegmented ovum up to the time at which the embryo escapes from its capsule. Embryonic development appears to follow the same course, broadly speaking, in all five of the Antarctic species, but differs considerably in such details as the size, shape and behaviour of spicules and in small details of histology.

The embryos of a single species, as represented by samples from several individuals, vary slightly in size, in the size and shape of the spicules, in the time at which the spicules appear and in the subsequent behaviour of these spicules; but such differences are small and are for the present purpose negligible. The specimens examined were all in the form of thin hand sections, cleared in clove oil, unstained or stained in borax carmine. In these preparations, the embryos appeared as solid bodies, but in a few instances specimens were found to have been satisfactorily sectioned by the razor. It was not possible, however, to study the histology in detail, this being reserved for a future occasion. The illustrations given represent optical sections and are intended mainly as accessory data for systematic study.

The embryonic development in *T. charcoti*, in which species a nearly complete series of embryos was obtained, may be conveniently dealt with under three headings: (i) the segmentation of the ovum and the differentiation of the cells so formed, (ii) nutrition, and (iii) the development of the spicules.

Tedania charcoti, Topsent

Segmentation. The ovum is first seen, in the deeper parts of the choanosome, as a semi-transparent body, charged with refringent granules, oval in shape, 0·1 by 0·07 mm., and lying in a capsule which is itself connected with the choanosomal tissues by radiating suspensoria (Fig. 47 *a*). The nucleus is at first faintly visible, but with the accumulation of food material is rapidly obscured. The first cleavage results in two cells of approximately equal size (Fig. 47 *e*), but the second gives rise to four cells of appreciably different sizes (Fig. 47 *f*). From this point onwards segmentation becomes very irregular (Fig. 47 *h*), but results finally in a spherical mass of cells (Fig. 47 *i*) of approximately equal size. Details of the intervening stages are missing, and the next stage in development seen is that represented by Fig. 47 *j*, in which the embryo, now oval and measuring 0·24 mm. in longest diameter, consists of a dense central mass of small granular cells, measuring 0·014 mm. in diameter, covered externally by a thin layer of much smaller, flattened cells. It is at this point that the first spicules make their appearance. After this the embryo increases considerably in size, becomes approximately spherical, 0·35 by 0·32 mm., and nearly transparent. A cortical layer of columnar cells becomes visible, 0·035 mm. thick, and the cells of the inner mass, now slightly smaller in size, are much more diffusely distributed. The succeeding stages are concerned mainly with changes in the distribution of the spicules (Fig. 47 *l*), and finally, a change in the outline of the embryo itself (Fig. 47 *m*). This latter is probably concerned solely with the escape of the embryo from the capsule, the walls of which have grown very thin (Fig. 47 *k*), and it appears as if the embryos are liberated from the capsule and make their way to the exterior by a series of quasi-euglenoid movements.

Nutrition. In the earliest stages, the embryonic capsule is thick-walled, and entirely empty except for the ovum, but in its walls may be seen a number of granular cells, spherical or oval in form, and measuring, on an average, 0·01 mm. across. Similar cells may also be seen in the suspensoria and in the adjacent choanosomal tissues. There can be little doubt that these are nutritive cells. Immediately prior to the first cleavage (Fig. 47 *b*) they become much more numerous and a few are seen migrating into the capsular cavity (Fig. 47 *c*), and as segmentation proceeds the cavity becomes partially filled with a granular mass (Fig. 47 *d*), derived presumably from the breaking down of these cells. The ovum, too, becomes more opaque and granular and assumes a golden yellow tint. After the second cleavage, the nutritive cells become appreciably less in the capsular wall (Fig. 47 *f*), the colour of the embryo deepening slightly, until in the later stages of segmentation they are only sparsely present. At this stage, raphides from the maternal tissues are carried in to support the wall of the capsule, which is from then onwards progressively reduced in thickness (Figs. 47 *h–j*). Finally, the wall loses its layer of raphides and becomes extremely thin (Fig. 47 *k*) in preparation for the escape of the embryo. The appearance of the raphides in the capsular wall appears to mark definitely the end of the nutritive period.

Development of Spicules. The first spicules to appear are extremely fine acanthostyli (Figs. 47 *j* and 53 *a*), 0·087 by 0·003 mm., lying in (or immediately beneath?) the outer layer of cells (cf. also *T. tenuicapitata*, Fig. 48 *c*). With the further differentiation of the embryonic tissues, as, for example, the formation of the outer cortical layer, the spicules migrate inwards, and become converted into smooth styli, measuring 0·14 by 0·007 mm. At the same time, small raphides, 0·07 mm. long, appear, scattered generally throughout the inner cell mass (Fig. 47 *k*). The further growth of the embryo is marked by a segregation of the styli in a neat bundle at the aboral pole of the embryo and a rapid multiplication in the numbers of the raphides (Fig. 47 *l* and *m*).

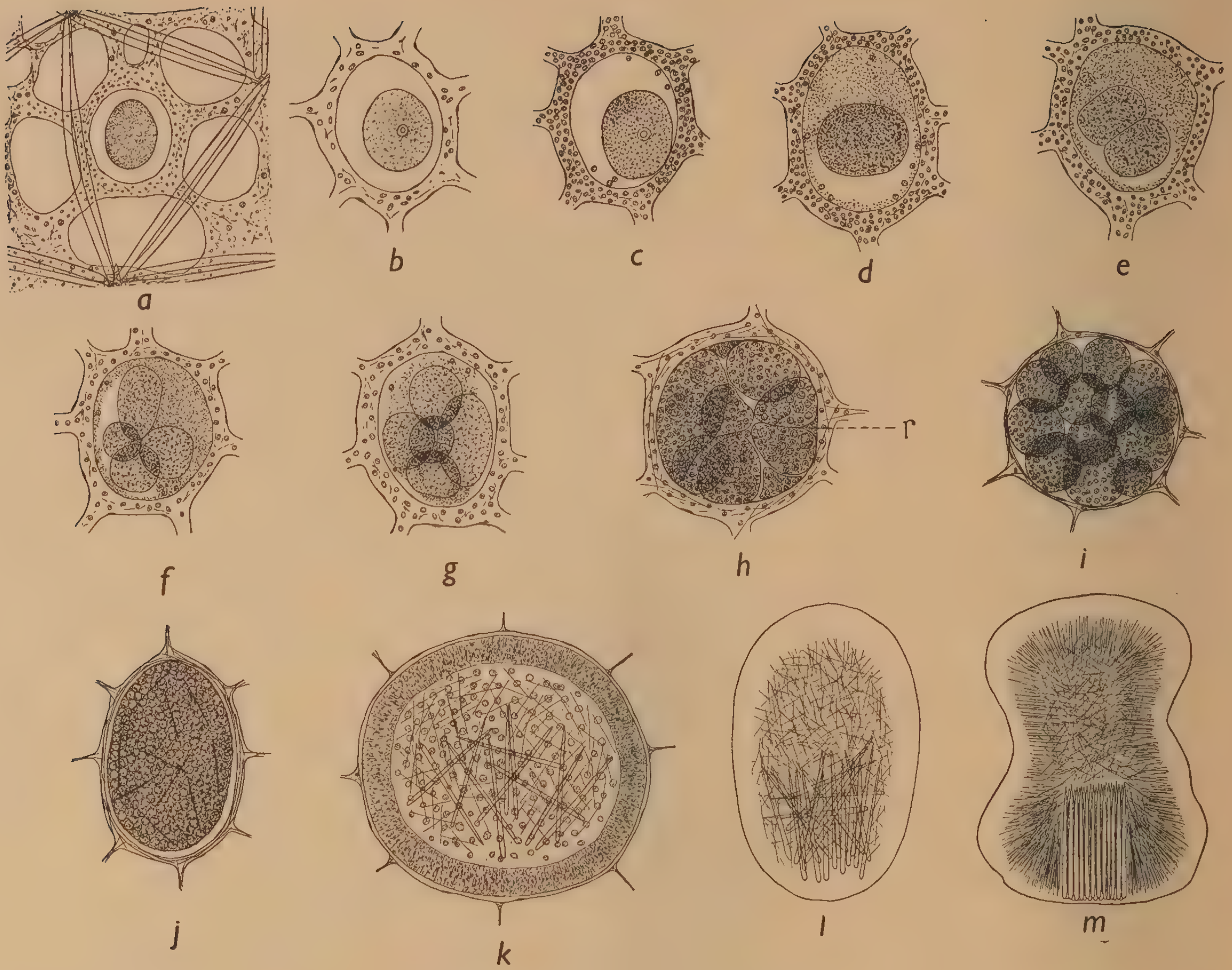
The raphides, the prototypes apparently of the adult onychaeta, resemble acanthostyli in their early stages, and it is probable that they are modifications of this spicule form, and not modifications of oxea, as is often inferred, and as appears to be the case in the raphides of other groups.

T. tenuicapitata, Ridley

Only a few embryos were found in three specimens, but from these it is clear that the development follows the same lines as that of *T. charcoti.* The earliest stage observed consists of a spherical mass of polyhedral cells contained in a capsule, the walls of which are strengthened with small onychaeta and contain a few nutritive cells (Fig. 48 *a*). The next stage found (Fig. 48 *b*) is of interest because in this the formation of the outer unicellular layer is seen to be in progress, but has not advanced sufficiently far for the inner cell mass to be completely covered. In addition, the formation of spicules can be seen to have begun in those parts of the outer layer which are well established. Fig 48 *c* represents a section through an embryo at a slightly later stage, and is intended to show the approximate position of the spicules in the early stages of their development. Fig. 48 *d* represents the latest stage obtained. The first spicules to appear are small roughened styli, 0·1 by 0·004 mm., followed by raphides, 0·07 mm. long.

T. murdochi, Topsent

Only the later stages were observed; and although the histology appears to be similar to that of *T. charcoti*, there are several points in which the embryos of the two species differ. The earliest embryo of *T. murdochi* is spherical and measures 0·28 mm., and the most remarkable feature about it is the manner in which the surface is thrown into loose folds (Fig. 50 *a*, *b*). The spicules are roughened subtylostyli, 0·14 by 0·003 mm., and raphides, 0·1 mm. long, and it may be remarked that, in contradistinction to the spicules of the embryos of other species, the subtylostyli of *T. murdochi* are arranged in opposite directions, some with the base directed orally and some with the base directed


a
b
c
d
e
f
g
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m

Fig. 47. *Tedania charcoti* (Topsent).
(In Fig. 47 *h*, *r* = residual nutritive matter.)

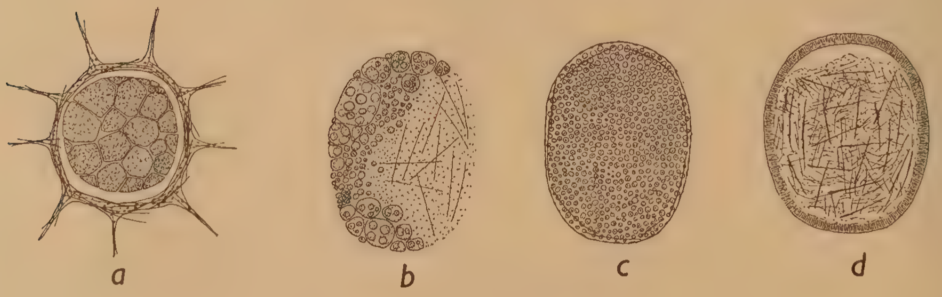

Fig. 48. *Tedania tenuicapitata*, Ridley.

EMBRYOLOGY OF ANTARCTIC

Note: All embryos are contained within a capsule,

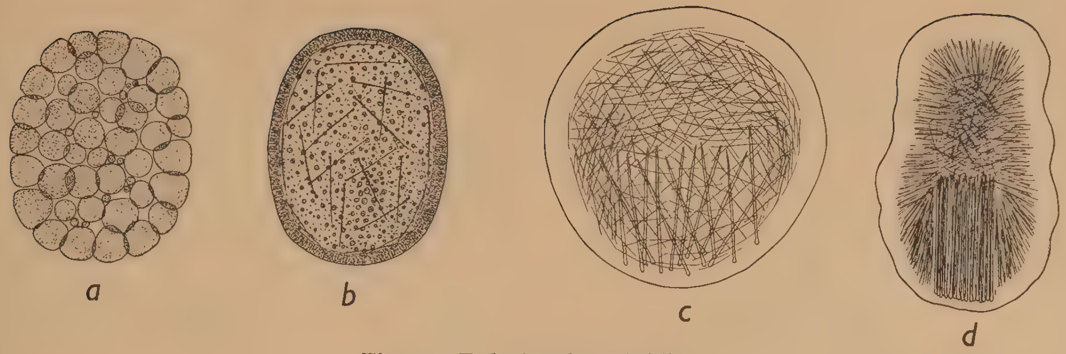

Fig. 49. *Tedania spinata* (Ridley).

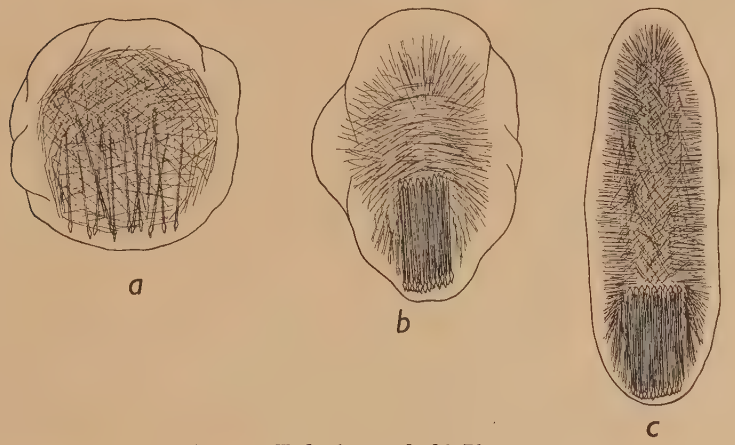

Fig. 50. *Tedania murdochi*, Topsent.

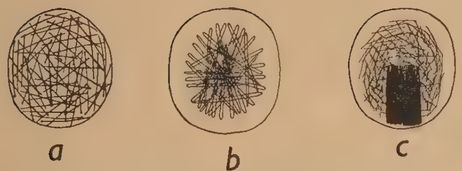

Fig. 52. *Tedania pectinicola*, Thiele.

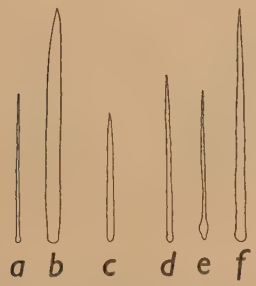

Fig. 53. Embryonic spicules: *a–b*, *T. charcoti*; *c*, *T. pectinicola*; *d*, *T. tenuicapitata*; *e*, *T. murdochi*; *f*, *T. spinata*.

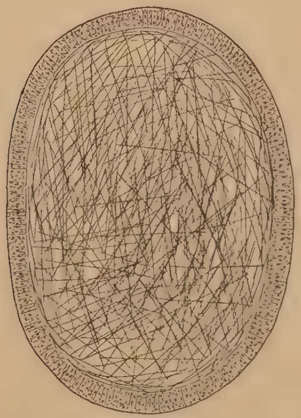

Fig. 51. *Tedania massa*, Ridley and Dendy.

whether this structure is figured or not, except 49*c*.

aborally (Fig. 50 *b*, *c*). After escape from the capsule the embryo assumes an elongated form (Fig. 50 *c*) and the conspicuous folds of the surface disappear.

T. spinata (Ridley)

The first stage observed consists of a sub-spherical mass of spherical to polyhedral cells of varying size, 0·035–0·07 mm. in diameter, the whole being 0·28 mm. long by 0·22 mm. across (Fig. 49 *a*). The subsequent histological changes resemble those of *T. charcoti* and result in an oval embryo with a central mass of granular cells and an outer, cortical layer of columnar cells (Fig. 49 *b*). The first spicules to appear are roughened styli, 0·15 by 0·004 mm., followed by raphides measuring 0·07 mm. long. The subsequent changes are similar to those found in *T. charcoti* (Figs. 49 *c* and *d*).

T. massa, Ridley and Dendy

A few large embryos (Fig. 51) were found in two specimens, all at about the same stage of development, so that it is impossible to say much concerning the development in this species. Two important features may, however, be noted: (i) the large size of the embryos, and (ii) that the first spicules to appear are raphides, measuring 0·14 mm. long.

T. pectinicola, Thiele

Although this species does not figure in the Discovery collections, drawings of embryos found in the type specimen are included (Fig. 52 *a–c*) for the sake of comparison with other species.

Other species in which embryos were found are:

Plakina monolopha, Schulze. A specimen, collected on January 17, contains numerous embryos in various stages of development.

P. trilopha, Schulze. One specimen collected on December 23 contains a few ova; the second, collected on March 14, is filled with embryos in all stages of development and a section of it presents the same appearance as that figured by Schulze (1877, pl. iv, fig. 20) for *Oscarella lobularis* (Schmidt). This is the first time the embryos of *Plakina trilopha* have been recorded, and although Schulze has figured the developmental stages of *P. monolopha*, which so far as they go do not differ from those of *P. trilopha*, he omitted to record the date on which reproduction takes place.

Haliclona bilamellata, sp.n. Two specimens, collected in April, contain scattered ova or embryos in very early stages.

Callyspongia flabellata, sp.n., collected in March, contains numerous oval embryos, 0·18 mm. in longest diameter. A few are aspiculous, but most of them contain oxea, 0·039–0·06 by 0·002 mm., which appear to arise as a tangential layer in the epiblast and then to migrate inwards to form, finally, a compact mass at the centre of the embryo (Fig. 54).

Isodictya setifer (Topsent). A specimen, collected on March 21, contains eggs (or young embryos?), spherical and with granular appearance, 0·087 mm. in diameter. A second specimen, collected on March 14, contains numerous large embryos, spherical or oval in shape, of a rich yellowish brown in colour which makes them very conspicuous, and measuring up to 1 mm. in longest diameter. There is no sign of spicules or of a marked differentiation into an inner cell mass and an outer layer of smaller cells.

Isodictya antarctica (Kirkpatrick). A specimen, collected on June 21, contains numerous large embryos similar to those of *I. setifer*, but more golden yellow in colour and measuring up to 0·8 mm. in diameter.

Guitarra fimbriata, Carter. A specimen, collected on July 17, contains a few aspiculous embryos, situated just beneath the surface, and measuring 0·1 mm. in diameter.

Mycale magellanica (Ridley). A specimen, collected on September 20, contains a few embryos in an early stage of development, 0·12 mm. in diameter.

Amphilectus fucorum (Johnston). A specimen, collected on March 24, contains numerous aspiculous embryos, spherical or oval, measuring 0·28 mm. in diameter, and a second specimen, collected on May 1, has oval embryos measuring 0·16 mm. in longest diameter.

Asbestopluma calyx, Hentschel. A specimen, collected on January 20, contains numerous embryos in an advanced stage of development. The spicules contained are clavate tylostyli (or styli), 0·1 by 0·007 mm., and anisochelae, 0·011 mm. chord. In the earliest stages seen tylostyli only are present, forming a compact bundle at the centre of the embryo. In others anisochelae have made an appearance and are scattered irregularly around this bundle, and in the most advanced embryos the bundle of tylostyli is surrounded at its upper (?) end by a dense corona of anisochelae (Fig. 54 *k*).

Iophon radiatus Topsent. Specimens, collected from January 9 to June 21, all contain embryos in an early stage of development. Those described by Kirkpatrick (1908), which are at a later stage of development, were obtained in February.

Anchinoë latrunculioides (Ridley and Dendy). A single specimen, collected on June 17, contains large oval, aspiculous embryos, measuring 0·4 mm. in longest diameter.

Anchinoë leptochela (Hentschel). The single specimen, collected in April, contains numerous embryos. Some are aspiculous, slightly flattened at one pole and measuring 0·32 mm. diameter. Others, of approximately the same size but regularly spherical, contain numerous chelae of the same shape as those in the adult and, in some instances, a few acanthostyli. The chelae measuring 0·021 mm., about two-thirds the size of those of the adult, and the acanthostyli 0·092 mm. long.

Kirkpatrickia variolosa (Kirkpatrick). One specimen, collected on December 19, is filled with spherical embryos, 0·036 mm. diameter, most of which are in a comparatively early stage of development. The most advanced stage, and one rarely met with in this specimen, shows a compact central mass of cells with a single epiblastic layer, and internally a few incipient acanthostyli 0·035–0·12 mm. long.

Plocamia gaussiana, Hentschel (Fig. 54 *e–i*). Several specimens contain embryos: those taken in December contain only a few aspiculous embryos (i.e. early stages); those taken in January contain numerous embryos in varying stages of development, but all, or nearly all, possessing spicules. From these, the course of development may be

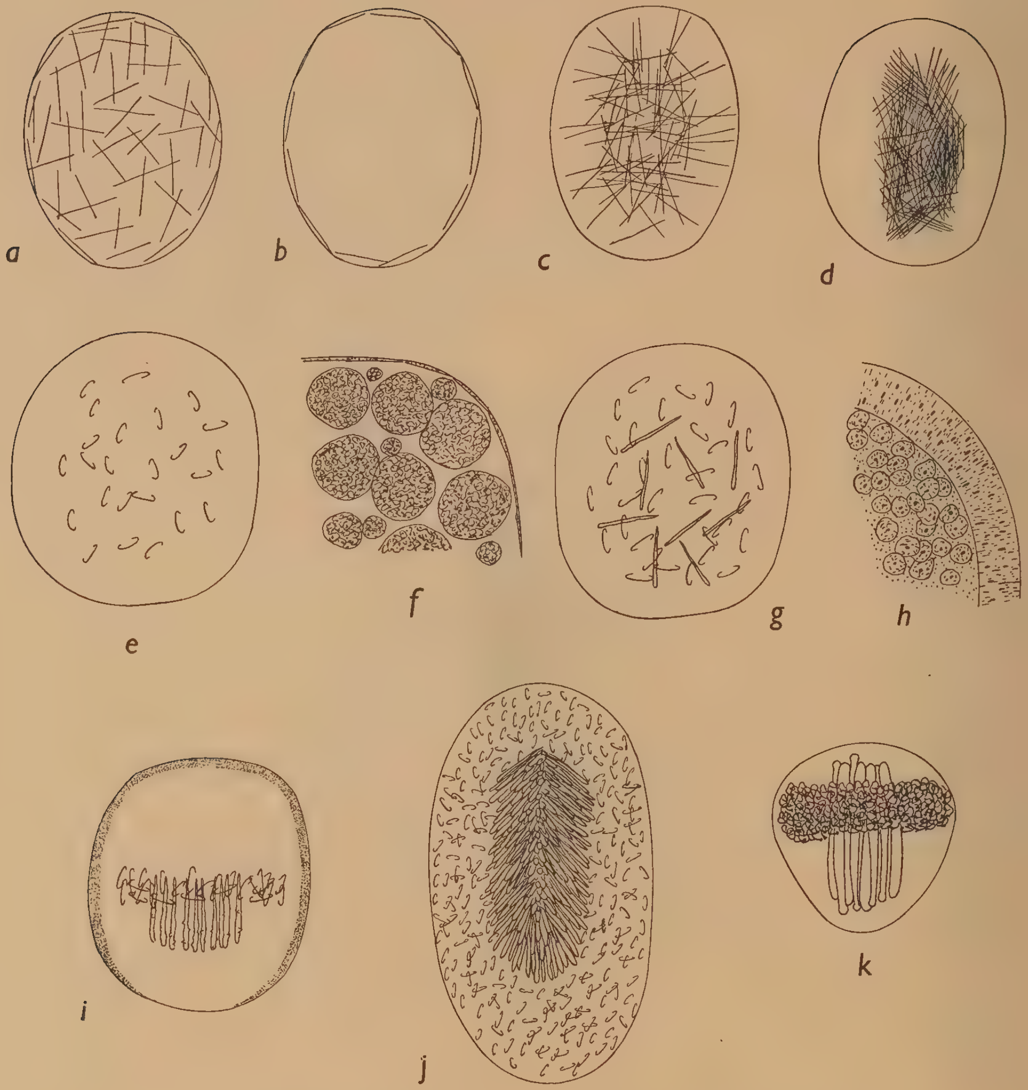

Fig. 54. Embryonic development in certain species of Tetraxonid sponges.

a–d, *Callyspongia flabellata*, sp.n.

a, embryo after first appearance of spicules; *b*, section of same, showing spicules in a tangential layer; *c*, spicules migrating inwards; *d*, latest stage observed. × 200.

e–i, *Plocamia gaussiana*, Hentschel.

e, embryo after first appearance of spicules; *f*, sector of same to show dermal epithelium and large granular cells of inner mass; *g*, first appearance of acanthostyli; *h*, sector of an embryo at a slightly later stage, showing columnar external layer; *i*, latest stage observed. *e*, *g*, *h* × 100, *f*, *h* × 250.

j, *Dictyociona discreta* (Thiele). The latest stage observed, with dense axial core of plumosely arranged acanthostyli. × 200.

k, *Asbestopluma calyx*, Hentschel. Embryo. × 160.

followed. The aspiculous embryos are spherical and attain a maximum diameter of 0·36 mm. and show an inner mass of large irregular cells with a thin layer of flattened cells on the outside. From this point a decrease in size takes place to 0·3 mm. diameter, the central mass becoming more compact and the outer layer being clearly marked off as a thick layer, 0·035 mm. thick, of columnar cells. At first the outer layer is of uniform thickness throughout. The first spicules to appear seem to be the chelae, which measure 0·026 mm. chord, as against 0·035 mm. in the adult, but do not otherwise present any peculiarities. They are scattered evenly through the central mass of cells. Small acanthostyli, 0·07 mm. long and differing considerably from those of the adult (cf. Fig. 54 *g*), then appear, also scattered through the substance of the central mass. A rearrangement then takes place, the acanthostyli finally being found in a bundle at the centre of the embryo and towards one pole, their apices centrifugally directed, with the chelae in a diffuse corona around the inner end of the bundle. At the same time, the outer layer of columnar cells becomes much thinner near the outwardly directed bases of the acanthostyli (Fig. 54 *i*). This may, by analogy, be regarded as the aboral pole.

The specimens recorded by me (1929, p. 435) from McMurdo Sound, taken in February, contain large aspiculous embryos.

Dictyociona discreta (Thiele) (Fig. 54 *j*). One specimen, collected in March, contains aspiculous embryos only, but a second specimen, collected in April, has a few spherical embryos, 0·32 mm. diameter, containing rare, almost indefinable, acanthostyli, and numerous others 0·25 mm. diameter, with a layer of acanthostyli measuring 0·07 by 0·002 mm. The acanthostyli are all lying tangentially to and just beneath the surface of the embryo. In a third specimen, collected in July, a single embryo was found containing numerous acanthostyli, arranged in a dense bundle at the centre, and numerous chelae of 0·008 mm. chord (cf. the oxea in *Callyspongia flabellata*, sp.n., Fig. 54 *d*).

Eurypon miniaceum, Thiele. Collected in October, contains ova and very young embryos.

Hymedesmia irritans, Thiele. A single specimen, collected at Tristan da Cunha on February 1, contains spherical embryos, aspiculous, measuring 0·16 mm. in diameter.

Hymeniacidon sanguinea (Grant). One specimen, collected on July 28 from Angola, contains numerous embryos up to 0·2 mm. in diameter. Most of the embryos are aspiculous, but some contain styli, with faintly irregular surfaces, measuring 0·12 by 0·003 mm. These spicules are at first arranged tangentially to the surface, but later migrate inwards to lie in a confused mass towards the aboral (?) pole with their apices directed towards the centre of the embryo.

Hymeniacidon dubia, sp.n., collected in March, contains ova and very young embryos.

Plicatellopsis flabellata, sp.n. The specimen, collected on June 22, contains a few oval embryos, 0·07–0·1 mm. in longest diameter, in early stages of development.

Stylocordyla borealis (Lovén), subsp. *acuata* (Kirkpatrick). A single specimen, collected on December 15, contains numerous embryos in an advanced stage of development and a few that are entirely aspiculous. Embryos have been found in the Terra

Nova specimens of this subspecies in January, and in the Challenger specimens of the subspecies *globosa*, also in January.

Polymastia isidis, Thiele. One specimen, collected on July 17, contains numerous sperm morulae, 0·045 mm. in diameter, in the inner tissues, and indications near the surface that budding was about to begin. Around the outer ends of the bundles of the main skeleton are gathered masses of cells of a peculiarly yellow and granular appearance, and if we may judge from Eichenauer's (1915) work on *Tethya maza*, Selenka, these are groups of amoebocytes (? archaeocytes) which will eventually form the bulk of the substance of the buds.

Sphaerotylus antarcticus, Kirkpatrick. Very young specimens are recorded by Kirkpatrick (1908, p. 17) which were collected in January, June and September respectively, and as these young specimens were approximately of the same size, it is probable that some form of reproduction goes on in this species all the year round. This is probably an asexual budding. *S. schoenus*, Sollas, was also recorded by the same author to be actively budding in January.

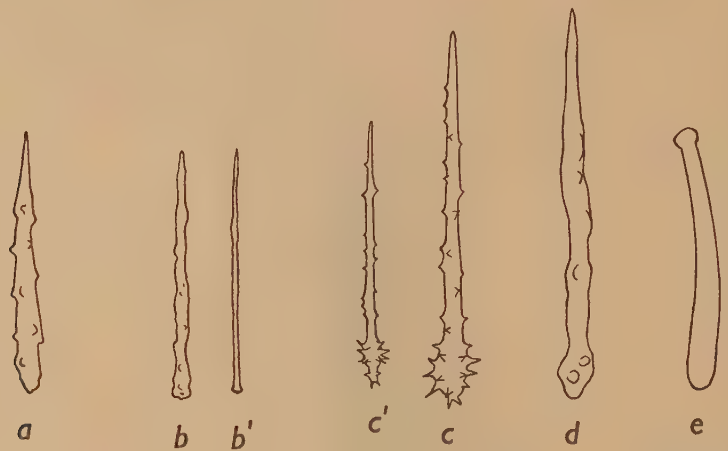

Fig. 55. Embryonal megascleres of *a*, *Plocamia gaussiana*, Hentschel; *b*, *Dictyociona discreta* (Thiele); *c*, *Anchinoë leptochela* (Hentschel); *d*, *Kirkpatrickia variolosa* (Kirkpatrick); *e*, *Asbestopluma calyx*, Hentschel. All × 500, except *e*, which is × 400 (*b'* and *c'* are developmental stages).

Spongia magellanica, Thiele. A specimen, collected on March 24, contains a number of spherical embryos, 0·07 mm. in diameter, showing a marked similarity to those of *Hircinia variabilis*, var. *flavescens*, figured by Schulze (1879, pl. iii, fig. 1), and especially to the one in the bottom left-hand corner of the figure. A clear area, spherical in outline, is readily discernible at one pole of the embryo. The embryos are found chiefly on or near the principal fibres of the skeleton.

POST-LARVAL DEVELOPMENT

Tetilla leptoderma (Sollas). There is a single small specimen from St. WS 27 which measures 3 mm. in diameter. The skeleton consists of radiating bundles of oxea, pro- and anatriaenes, which start from an excentrically placed nucleus. The form of the spicules is the same as in the adult, but the size is considerably less. The interesting feature about this sponge is that the small cortical oxea, instead of being set more or less at right angles to the surface, as in the adult, are arranged in a tangential layer at the surface.

BREEDING SEASONS

In the table given below, the evidence obtained from the finding of embryos *in situ*, based on the records of previous authors and the results of the present study, is brought

Table showing the approximate breeding periods of Antarctic species of sponges, as deduced from the finding of ova or embryos.

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Calcarea												
Achramorpha nivalis, Jenkin						——	——	——	——	······	······	······
Tenthrenodes scotti, Jenkin						······	······	——	······			
Megapogon raripilis, Jenkin						——	——	——	——	······	······	
Leucetta leptoraphis (Poléjaeff)	——	······	······								······	······
Tetraxonida												
Oscarella lobularis (Schmidt)								······	······	——	——	······
Plakina monolopha, Schulze	——	······	······								······	······
P. trilopha, Schulze	——	——	——	——								——
Craniella leptoderma (Sollas)	······				······	······	······	······	······	······	······	······
Cinachyra barbata, Sollas												
C. antarctica (Carter)												
Haliclona bilamellata, sp.n.			····	——	······	······	······					
Petrosia fistulata, Kirkpatrick						······	······	——	——			
P. depellens, Topsent						······	······	——	······	······		
Adocia tremulus (Topsent)	······									······	······	——
Hemigellius rudis (Topsent)	······	——	······									······
Callyspongia flabellata, sp.n.	······	······	——	······								
Isodictya antarctica (Kirkpatrick)				····	······	——	······	····				
I. setifer (Topsent)	······	······	——	······						······	······	······
Guitarra fimbriata, Carter					···	······	——	······	···			
Mycale magellanica (Ridley)								····	——	······	······	······
Amphilectus fucorum (Johnston)	···	······	——	······	——	··						
Asbestopluma calyx, Hentschel	——	······								····	······	······
Tedania charcoti, Topsent	——	——	——	······						······	······	——
T. massa, Ridley and Dendy			··	······	——	——	——	——	······	··		
T. spinata (Ridley)												
T. murdochi, Topsent		····	——	——	——	——	——	······	··			
T. tenuicapitata, Ridley					······	······	——	······	··			
Iophon radiatus (Topsent)	······	——	——	——	——	——	······	······				
Myxilla australis (Topsent)			······	······	——	······	······					
Lissodendoryx innominata, Burton	······	······	······									——
Anchinoë latrunculioides (Ridley and Dendy)				···	······	——	······	···				
A. leptochela (Hentschel)		····	······	——	······	····						
Kirkpatrickia variolosa (Kirkpatrick)	······	······	···								······	——
Plocamia gaussiana, Hentschel	——	——	······								······	——
Crella crassa (Hentschel)	——	······							······	——	······	······
Dictyociona discreta (Thiele)	···	······	——	——	······							
Eurypon miniaceum, Thiele	······								······	——	······	······
Hymedesmia irritans, Thiele	······	——	······	······								
Dolichacantha macrodon, Hentschel								······	······	——	······	
Hymeniacidon dubia, sp.n.			——	······	······	······	······					
Plicatellopsis flabellata, sp.n.					······	——	······	······	······			
Stylocordyla borealis acuata (Kirkpatrick)	——	······								···	······	——
Polymastia isidis, Thiele						······	——	······	······	······		
Sphaerotylus antarcticus, Kirkpatrick	······	······	······	······	······	······	······	······	······	······	······	······
Euceratosa												
Halisarca dujardini, var. *magellanica*, Topsent	······	······	······									——
Spongia magellanica, Thiele	····	······	——	······	····							

Where a definite record for a given month has been obtained, a black line is used: a dotted line signifies the approximate period, based on the stage of development reached in the embryos.

together in an endeavour to determine the breeding seasons for sponges in the Antarctic. It is clear that the records are by no means sufficiently complete to be able to draw definite conclusions from such a table; but the tentative deductions are interesting. In the first place, there does not appear to be any part of the year during which a majority of species are in a state of reproduction. The table shows that so far as can be told from the available evidence some species are breeding at all times of the year; but, as none of the specimens investigated were littoral, there is perhaps little surprising in this. Secondly, there is an indication that all or most species of Calcarea breed throughout the year, for although the number of specimens examined is relatively small, the number of records of ova and embryos is comparatively high. This might be said of the Euceratosa also.

Comparison with the breeding seasons in the northern hemisphere is difficult, partly again because of the paucity of observations (many authors have described embryos but omitted to give the date when they were seen), and partly because the records here are mainly from littoral or shallow-water specimens, whereas the Antarctic records are mainly from deeper water (down to 500 m.). Nevertheless, we again find that the Euceratosa are in a state of reproduction throughout the year, and again a suggestion that the same may be true of the Calcarea (cf. *Sycon raphanus*, Schmidt; see table given below). Further, there is a marked breeding period from approximately May to October.

Table showing the approximate breeding seasons of the European and North Atlantic species of sponges.

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Calcarea												
Sycon ciliatum (Fabricius)						———	———	———	······			
S. raphanus, Schmidt	———	———	———	———	———				———	———	———	
Grantia compressa (Carter)					———	———	———	———	······			
Leuconia aspera (Schmidt)			······	······	———	······						
Tetraxonida												
Oscarella lobularis (Schmidt)						———	———	———	———	———	———	
Haliclona oculata (Pallas)			······	······	······	———						
Mycale contarenii (Bowerbank)				······	———	———	······					
M. minima (Waller)				······	······	———	———	······				
Myxilla incrustans (Johnston)						······	······	······	———			
Hymedesmia dujardini, Johnston						······	······	······	———			
Halichondria panicea (Pallas)				———	———	———						
H. bowerbanki, Burton				······	······	······	———	———				
Hymeniacidon caruncula, Bowerbank				······	······	······	———	———				
Tethya aurantium, Pallas							———	———	······			
Cliona celata, Grant				———	———	———	———	———	———			
Euceratosa												
Spongia officinalis, Linnaeus	———	———	———	———	———	———	———	———	———	———	———	———
Hippospongia equina, Schmidt	———		———	———	———	———	———	———	———	———	———	———
Hircinia variabilis, Schulze	———	———	———	······					———	———	———	———
Halisarca dujardini, Johnston	———		———	———	———	———	———	———	———	———	———	———

In the one case, *Oscarella lobularis* (Schmidt), of a species common to the North Atlantic and the Antarctic (in which the breeding season is known) it is found that the same season is occupied in each locality. Thus, in the northern hemisphere, this species is, presumably, reproductively active from June to November, and in the Antarctic, from August to December.

UNATTACHED SPONGES

In discussing the possible means by which the distribution of sponges is effected (see p. 358), the assumption is usually made that there is no such thing as a free-living sponge capable of being transported in the adult stage by currents. Certain specimens of *Tedania tenuicapitata*, Ridley, in the present collections indicate the possibility that even adult sponges, often of large size, may pass their life floating just above the sea-floor, or at least resting unattached on the sea-bottom and capable of being lifted by currents of moderate force. This[1] may help to explain a number of anomalies previously observed in other species; and, in view of the importance of such observations as possibly affecting geographical distribution and the bionomics of sponges as a whole, it will be of interest to deal fully with the subject.

The sole means of observing sponges in the living state is confined to observation between tide marks, in aquaria, and in exceptionally favourable circumstances, with a diving helmet. In the first two, it is obvious that nothing in the nature of floating sponges can be observed, and in the third, the results of such investigations have never been recorded. It is necessary therefore to rely on indirect observation of preserved material.

Tedania tenuicapitata, Ridley, is represented in the present collections by some 200 specimens. Most of these are damaged or at least incomplete at the base, presumably where the trawl has torn them from the substratum. A few are, however, entire, and some of these show no visible sign of having been attached either to the sea-floor or to any such object as a hydroid or polyzoon. For the most part, such specimens are sub-spherical and of small size. There are, in addition, three discoid specimens which seem to offer convincing evidence in support of the suggestion that some sponges may not be permanently fixed to the substratum and, under favourable circumstances, slightly buoyant.

The first of these specimens (Fig. 56 *a*) is discoid, 16 cm. across, 12 cm. high and 3 cm. at the thickest point. The margin is even, and a cross-section in any direction shows a fairly regular ellipse (Fig. 56 *b*). At the base, the sponge is attached to the concave inner surface of a bivalve shell, and between the shell and the adjacent sponge tissue is a small quantity of sand. The margins of the sponge which encroach on the outer surface of the shell are, however, entire, without sand inclusions, and show no sign whatsoever of having at any time been attached to the substratum, rock, stone or hydroid, or of having been in contact with, or buried in sand. Further, there are several hydroids growing on the shell, and in each case these point downwards. The only possible assumption is that the sponge was free-living and, since it was obtained in a trawl, floating just above the floor of the sea.

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[1] The idea is not novel, for Bowerbank (1866, p. 97) says of *Halicnemia patera*: "The habit of the sponge of including a small pebble in its centre, apparently as ballast, is very remarkable, and this is the only case in which there is an indication of a natural tendency to locomotion belonging to the adult species that I have ever observed among the Spongiadae".

The second specimen is even more convincing. This is more regularly discoid (Fig. 56 *c*), 21 cm. high by 17 cm. across by 3 cm. thick at the centre. The margin is entire throughout, with no sign of attachment, and the only inclusions are a few patches of sand at the centre and a small pebble embedded in the lower third (Fig. 56 *d*). Some hydroids are growing out from the surface of the sponge, and the direction in which they are pointing suggests that the sponge floated vertically (as figured) with the portion containing the pebble lowermost.

The third specimen has much the same shape and size as the second, but is entirely without large inclusions, shell or pebble. The margin is entire throughout, but at several widely separated points on it there is a peculiar roughening of the surface, suggesting incipient rooting processes, as though the sponge, although unattached, had at times come to rest on the sea-floor sufficiently long for rooting processes to start growing.

That there can be no question of these sponges having been erect, with their bases permanently embedded in sand,[1] can be proved from the following:

(i) Although members of the species readily take up sand (see below) these specimens are particularly free from it.

(ii) The tissues and skeleton are normal throughout the entire margin.

(iii) Flagellated chambers are present just beneath the surface throughout the margin. (Had these sponges been embedded in sand, it is unlikely that the flagellated chambers would have persisted in the submerged portions.)

With regard to the first point, the ease with which individuals of *Tedania tenuicapitata* will absorb sand grains is shown by the majority of the Discovery specimens. In some cases, the inclusions are confined to the base, which was presumably buried in the sand, but in most cases sand is found throughout the specimen (Fig. 56 *g*). Fig. 56 *e* shows a section of a flabellate specimen with a sandy base, and Fig. 56 *f* shows an irregularly "table-shaped" sponge (spreading horizontally) with several "legs" which were buried in the sand at the base. In view of this therefore it is improbable that the margins of the discoid specimens could have been in contact with the "coarse brown sand" of the sea-floor without showing some trace of its inclusion.

It is noteworthy that both the discoid specimens, when immersed in 80 per cent. alcohol, only just sink. That is to say, they will sink, but the slightest touch on the under surface, when the specimens are standing erect, will cause them to rise in the spirit. This feature is more strongly marked than in any other preserved sponge experimented with. Since the specific gravity of sea water is greater than that of alcohol, it is reasonable to suppose that these particular sponges would be unusually buoyant.

Other examples of sponges which may have floated above the sea-floor may be easily found. The young of *Cinachyra barbata*, Sollas, for example, are sub-spherical (cf. Kirkpatrick, 1908, Plate ix, fig. 3), completely covered with a surface pile of spicules and showing no sign of having been attached; and the same may be said of adult specimens up to 10 cm. in diameter. Many specimens of *Thenea* show no evident point of attachment, while *Cinachyra antarctica*, Carter, only rarely shows a basal tuft. In that species, the usual form is sub-spherical, with projecting tufts of spicules and numerous porocalices distributed evenly all over the surface (see Lendenfeld, 1907, Plate xxii, figs. 22–33, under *Cinachyra vertex*). Were such a sponge to lie on the sea-floor, some of the porocalices would be rendered useless, and would probably disappear as a consequence, and the ends of the spicule bundles would almost certainly be damaged. And further, the projecting spicules in the, supposedly, free sponges, as opposed to the rare examples of this species in which a basal tuft is present, are more markedly spiral in arrangement, suggesting that the sponge has been subject during development to a gentle rotary movement.

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[1] Coarse brown sand formed the substratum at Sts. WS 222 and WS 96 where these sponges were found.

It is difficult to imagine *Disyringa dissimilis*, Sollas (Fig. 56 *i*), leading anything but a free existence, and it is interesting to compare this with the three known species of an allied genus, *Monosyringa*. The first of these, *M. longispinum* (Lendenfeld), is spherical with an oscular tube (Fig. 56 *k*) and the body is covered with delicate sucker-like processes. In this species there is no sign of attachment and the processes are all free, but in *M. mortenseni*, Brøndsted and *M. brondstedi*, Burton, the known individuals, identical in external form with *M. longispinum* (Lendenfeld), are covered with pebbles and calcareous debris, each pebble or fragment being attached to the sponge body by one or more of the sucker-like processes (Fig. 56 *l*). Presumably, as there is no evidence of other point of attachment, these species may be free-living or may attach themselves to numerous small bodies which serve as anchors, or rather ballast.

In all probability, the species described by Ridley and Dendy (1887) as *Cladorhiza longipinna*,[1] *C. similis*, *C. inversa* and *Axoniderma mirabile* are also free-living forms. It is, at least, questionable whether the radiating processes would serve "to support the sponge in the soft mud on which it lies" (*loc. cit.*, p. 94). Rather would it appear that the shape here is an adaptation to a free-living existence, especially by analogy with *Crinorhiza* and certain Echinoderm larvae. The sponges of this genus are probably figured upside-down by Ridley and Dendy (cf. Fig. 56 *j*).

Another species which appears occasionally to be free-living is *Polymastia invaginata*, Kirkpatrick. In most cases, the individuals of this species are attached to stones of sufficient size to anchor them to the substratum, but in others there is reason to believe that, although a pebble is embedded in the base, the sponge actually floated above the level of the sea-floor. In a few individuals in the Terra Nova collections, there is no sign at all of attachment (Fig. 56 *n*), in others there is likewise no sign of attachment but a small pebble is present in the centre of the under surface (Fig. 56 *m*). This suggests that the larva originally settled on a pebble, but from the shape of the adult it seems unlikely that the sponge could have rested permanently on the bottom. The most illuminating specimen of this species is, however, one recorded by Kirkpatrick (1908),

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[1] Topsent (*C.R. Acad. Sci. Paris*, CXXXIV, 1902, pp. 58–60) has advanced anatomical arguments for believing that the habitual poise of these species is contrary to that suggested by Ridley and Dendy. I, too, have found that no matter how the specimens be thrown into a liquid they quickly and invariably assume the orientation shown in Fig. 56 *j*.

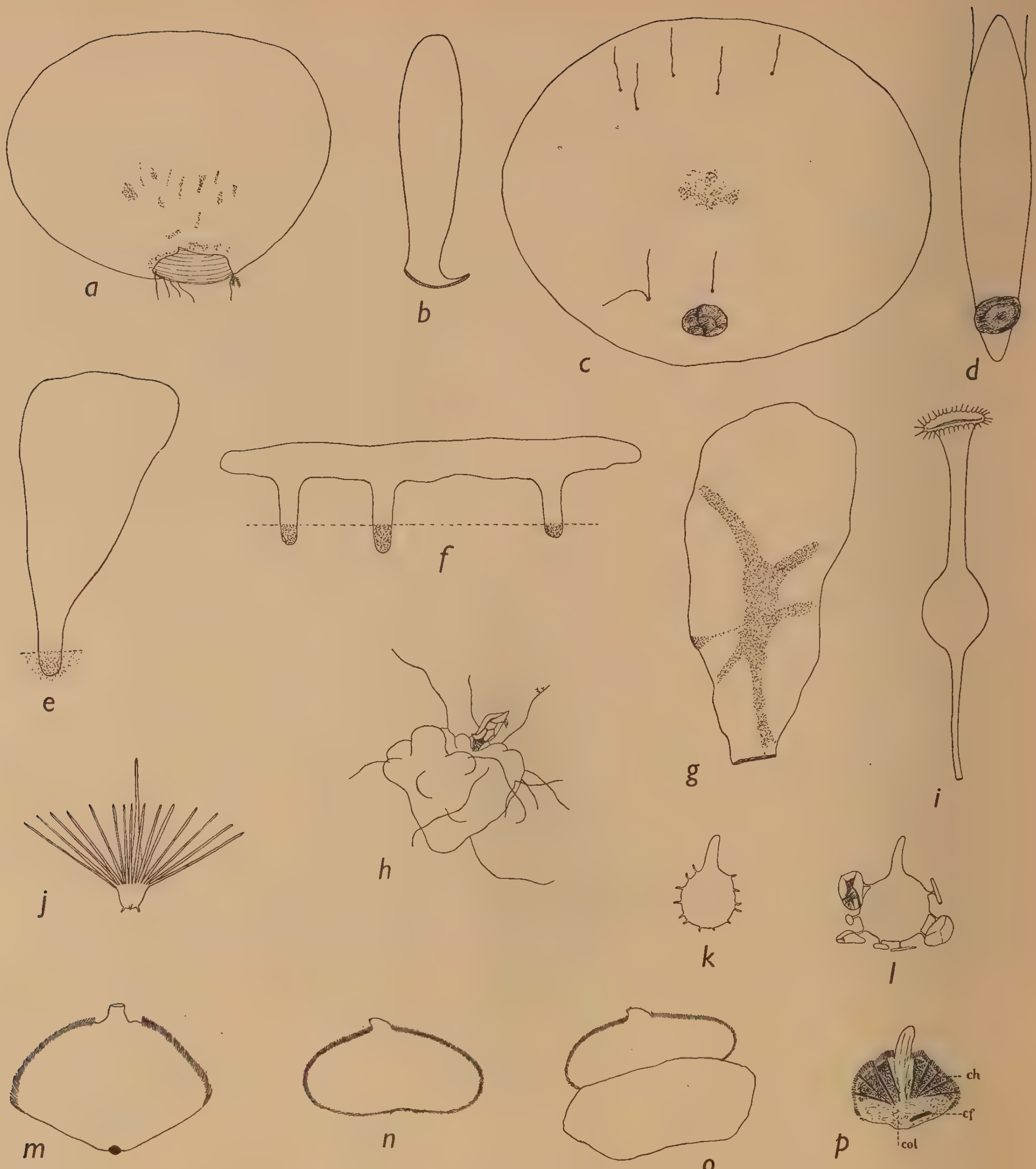

Fig. 56. Sponges with little or no attachment to the substratum.

a–h, *Tedania spinata* (Ridley).

a, a discoid specimen, with hydroids growing vertically downwards from the basal shell and small patches of included sand; *b*, section of same; *c*, a second discoid, with included pebble, hydroids growing out from the surface and included patch of sand at the centre; *d*, section of same; *e*, a flabellate specimen, showing method of attachment; *f*, a "table-shaped" specimen, showing method of attachment; *g*, section through a flabellate specimen, showing manner in which sand is taken up by the sponge; *h*, a sub-spherical specimen, bearing hydroids and a cirripede, from St. 222, taken in a tow-net. *a–g* × $\frac{1}{3}$, *h* × $\frac{1}{2}$.

i, *Disyringa dissimilis*, Sollas. × 1.

j, *Cladorhiza longipinna*, Ridley and Dendy, showing orientation. × 1.

k, *Monosyringa longispinum*, Lendenfeld, showing suckers.

l, *Monosyringa brondstedi*, Burton, showing suckers with attached pebbles, etc. × 1.

m–p, *Polymastia invaginata*, Kirkpatrick.

m, a (floating ?) specimen with a small pebble embedded in the base; *n*, a "free" specimen; *o*, a specimen seated on a rock; *p*, section through a young specimen, showing choanosome (*ch*), collenchymatous base (*col*) and included calcareous fragment (*cf*). *m–o* × $\frac{1}{3}$, *p* × 2.

1 cm. in diameter, in which the lower (?) half of the sponge consists only of collenchymatous (gelatinoid) tissue completely enclosing fragments of calcareous debris (Fig. 56 *p*). The collenchymatous portion naturally suggests something in the nature of a float, with the fragments of debris acting as balancers.

Except for the species of *Cladorhiza* and *Axoniderma*, which may be habitually free-living, *Disyringa* and *Monosyringa*, which may be occasionally free-living, it is probable that the larvae first settle on small stones or pebbles, perhaps even large sand grains. If these be sufficiently heavy the sponge becomes attached for life; but if small, the growing sponge will gradually lift the stone or pebble on which it has settled, as their combined specific gravity decreases, and even, eventually, become grown round the stone or pebble, entirely enclosing it. In this connection it must be remembered that the specific gravity will vary from species to species, or from one individual to another of a single species, accordingly as the skeleton is slightly built or densely constructed, the relative quantities of spicules in individuals of a given species being subject to considerable fluctuation. It may, on the other hand, be argued that no organism with tissues charged with silica and devoid of appendages or special organs of flotation could possibly do anything else than remain permanently on the bottom. Yet, since the tissues of many sponges are densely charged with fat globules, and the spicules are not solid silex but contain an axial canal, it is possible that the specific gravity of sponges generally is less than is usually assumed.[1] The only real test worth applying would be specific gravity readings on the (apparently) unattached forms while still alive. One thing, at least, is clear, that many species of sponges are definitely free-living, and there is every indication that some of these at least may not rest permanently on the floor of the sea.

THE VALUE OF EXTERNAL FORM IN THE IDENTIFICATION OF SPONGES: WITH NOTES ON VARIATIONS IN THE SIZE AND SHAPE OF SPICULES

In the early days of the systematic study of sponges, external form was the only thing considered worthy of description. It was, in fact, not until after 1860, when Bowerbank and Schmidt published their well-known monographs, that the spicules were seriously considered as diagnostic features. In a very short time, the skeleton became the chief object for study by the systematist. To-day, considerably more attention is paid to the skeleton in the description of a new species than to the external form, and the tendency is rather towards omitting illustrations of the external form. As a result of my own experience, I am coming to the conclusion that, for the identification of species, external form is a more reliable feature than the skeleton; that it is more constant than the shape of the spicules, and far less variable, under normal conditions, than is usually assumed.[1] In addition far too little attention has been paid to the construction of the skeleton. In my opinion, the surest guide for the diagnosis of families is found in the types of spicules present; for genera, their arrangement and disposition in the skeleton, with minor variations in their shape; for species, the external form, with the minor variations in the arrangement of the spicules, and, less important, the categories of spicules present. In other words, the best method of identification lies between that adopted prior to 1860–70 and that which has been in use since.

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[1] I am indebted to members of the Discovery Staff, Dr Mackintosh and Mr Fraser, for the information that many specimens of *Tedania*, notably *T. massa*, emit large quantities of mucus when taken from the dredge. The presence within the tissues of large quantities of mucus would possibly result in lowering totally the specific gravity of the sponge as a whole, and it is conceivable that the texture and volume of a preserved specimen of *T. massa* differ appreciably from those of the living sponge.

Another practice which is to be deplored is that of founding species on badly damaged specimens, fragments of specimens and obviously pathological individuals (including those which occasionally replace their proper skeletons by sand or foreign spicules). Such objects, used as holotypes, give infinite trouble and rarely can their true characters be ascertained.

If, however, the skeleton is to be used in so important a role, it is at least time that some systematic effort were made to determine the extent of variation (i) in size, (ii) in shape, and (iii) in arrangement. Also, to collect data on the extent to which categories of spicules may disappear in individuals of a species, or be differentiated into two or more sizes. In studying the sponges collected by the Discovery expeditions, the following observations have been made and appear worthy of record:

Variation in the size of spicules

The first important observation on this point concerns *Calyx arcuarius* (Topsent). The oxea in the type measure 0·35 mm. long, in the specimens recorded by me (1929, p. 422), 0·27–0·35 mm., not 0·2–0·3 mm. as stated, in the present specimens of the Discovery, 0·22–0·24 mm., and in a specimen collected at South Georgia by Mr P. Stammwitz, 0·15 mm. long. The spicules of the last specimen are less than half the size of the maximum recorded.

In *Axociella flabellata* (Topsent) the large styli and dermal subtylostyli have a maximum of 1·0 and 0·650 mm. respectively, in the Terra Nova specimens and, in one of the present specimens, of 1·2 and 0·640 mm. In the other Discovery specimen and a specimen collected by the Shackleton-Rowett expedition, 0·64 and 0·35 mm. respectively. Again, the maxima recorded are twice the recorded minima.

In *Iophon proximum* (Ridley), the acanthostyli vary from 0·14 to 0·44 mm. (taking average sizes in different individuals), and the tornota from 0·14 to 0·315 mm.

It is clear from these examples alone that such phrases as "this species differs from... in the greater size of its spicules", are useless. *Ceteris paribus*, spicule size can have no significance for the systematist, and it is only necessary to count the number of varieties, subspecies and species described in the literature devoted to Antarctic sponges, and founded on spicule size alone, to realize this.

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[1] Strong objection is here taken to the all too prevalent use of the term "amorphous" in describing the external form of sponges. The term has been used to include encrusting, massive, lobate, sub-digitate, clathrate and plicate sponges, and a number of combinations of two or more of these. The type of one of Lendenfeld's species of Australian Chalininae is a beach-worn sponge which has been, presumably, trodden under foot. This was described as "amorphous" and is the only truly amorphous sponge I have ever seen.

Variation in the shape of spicules

The shape, too, of spicules is not so constant as is commonly supposed. It will vary more in one species than another, it is true, and from one stage in the life of an individual to another (cf. Burton, 1931), but in all species allowance must be made for these minor differences, instead, as has been the practice, of investing them with specific importance. A good example of this is given under *Iophon proximum* (Ridley) (see pp. 296–301), but the most striking case, which I hope to deal with in a forthcoming report, concerns *Clathria toxipraedita*, Topsent, in which the ornamentation of the acanthostyli, styli and dermal subtylostyli is very variable, while the general shape of these spicules also varies considerably.

The arrangement of the spicules in the skeleton is more constant than either their shape or size, but even here variations are found which can be very misleading. In appreciating the unreliability of the skeleton for systematic study, we are driven therefore to accept the external form of the sponge as the final and deciding criterion in its identification.

The suppression of microscleres

The dropping out of categories of spicules is a common phenomenon, but one which is not sufficiently appreciated. This seems to be particularly evident among the Mycaleae, but all types of sponges are liable to it. It is probable that sufficiently long searching would show that the apparently absent spicules will be found to exist, even though in minute quantities, in some parts of a sponge. That may or may not be true, but in any case the practical difficulty still remains. Apropos this point, there is a specimen of *Mycale magellanica* in the present collection in which no spicules other than tylostyli could be found; yet the external form showed it clearly to belong to that species. I have myself described (1930, p. 333) as *Axinosia incrustans*, sp.n., a specimen which proved eventually to be an *Amphilectus fucorum* (Johnston) with very rare chelae. Most of the species of *Reniera* described by Dendy (1921) from the Indian Ocean contain rare sigmata, which may be found only after prolonged search. Numerous examples of this could be related (see also *Mycale magellanica*, p. 288), yet to suggest that microscleres are an unreliable criterion for taxonomic purposes is to make an unwelcome proposal. The fact is that they are secondary in importance to the structure of the main skeleton.

Differentiation within a single category of spicules

Thiele (1898, pp. 13–14) describes two species of *Stelletta* from Japan, *S. validissima* and *S. orientalis*, the former having oxea, dichotriaenes, protriaenes and two sorts of anatriaenes, the latter having oxea, dichotriaenes, protriaenes and only one sort of anatriaene. Both are from adjoining localities, have the same external appearance, and are, indeed, similar in all respects but the possession of two sorts of anatriaenes by the one species, and one sort by the second species. It seems unreasonable to doubt that the two species are identical, but for this it must be presupposed that any category of spicule is capable of differentiation into two sizes. A striking example of this is found in *Craniella disigma*, Topsent (1904, p. 100), which differs from *Tetilla cranium* (Müller) Autt., in one respect only, that it has two sizes of sigmata instead of one. Here, again, it seemed probable that *Craniella disigma* was identical with *Tetilla cranium*. To test this I took a jar from the Porcupine collection, containing some thirty specimens identified by Carter as *Cranilla cranium* (Müller). Only one had been previously cut. The specimens were all alike externally and proved, on being sectioned, to be all alike internally; one of them, however, had two sizes of sigmata, exactly as in *C. disigma*, Topsent. Further, *Clathria frondifera*, var. *dichela*, Hentschel (1912), is probably a specimen of *C. frondifera* (Bowerbank) in which a similar differentiation has taken place.

Taking, now, all the variations to which the skeleton may be subject, it is not unreasonable to suggest that the external form may conceivably offer a more reliable means of identification, if only as the final arbiter.

THE ABUNDANCE OF SPONGES IN THE ANTARCTIC AND ITS GEOLOGICAL SIGNIFICANCE

According to Prestwich (*Geology: Chemical, Physical and Stratigraphical*, 1886, p. 125), "in their geological relations the forms and distribution of the sponges are of the highest interest". This being so it would be as well to be sure that the statements upon which geological arguments are based are correct. Merely a superficial acquaintance with geological literature is sufficient to show that this is not always the case. There is, for example, a strong belief among geologists, as shown by the literature, that the growth of sponges is most prolific in warm seas, and that, *a priori*, a deposit rich in sponge remains must have been laid down in a warm sea. The abundance of sponges in the Antarctic, as shown by the present collections, definitely proves that in recent times at all events this is not the case. Judging by the collections and by the verbal accounts of collectors, there is every reason to believe that sponges are at least as abundant in the Antarctic as in, say, the West Indies, Australia or the Indian Ocean. And the probability is that they are considerably more abundant. Certainly, the average size of the specimens exceeds that observed in any other part of the world. And finally, what is even more important from the geological point of view, whereas a large percentage of the sponges in warmer seas are keratose or pseudokeratose, the remains of which are unlikely to be preserved in a fossil state, those of the colder waters are almost exclusively siliceous, and the spongin, when present, does not form so great a percentage of the skeleton as in corresponding species in the warmer seas.

There is, further, the belief that sponges reached their "maximum development in the Cretaceous period". Again there is no evidence to support this. Neither in the complexity of the skeleton, the size of the spicules, the size of individual sponges, nor in the diversity of species, even when allowance be made for the fact that many species living in Cretaceous times are as yet unrepresented in our collections, can the Cretaceous fauna be said to have reached a degree of development greater than that represented by the sponges of the Antarctic to-day, or, for that matter, any other quarter of the globe.

And, finally, there is the question of the segregation of silica in the sea, in relation to the formation of chert and flint. Some geologists find it difficult to believe that the vast quantities of silica contributed annually to the sea by rivers (320,000,000 metric tons) can all be accounted for by the silica deposited as animal skeletons,[1] even allowing for a small percentage known to be deposited in a colloidal state in the normal course of sedimentation. Judging by the sponge fauna of the European or American coasts, there is doubtless some ground for such doubt, but if the Antarctic be considered too the case assumes a different aspect. Here, in a vast expanse of ocean, with the erosive forces calculated to contribute silica to the sea reduced to a minimum, the growth of siliceous sponges is greater than in any other part of the world: and it can only be supposed that the supply of silica in this area is drawn from other quarters. Even more important, however, is the suggestion that, when it is considered how many siliceous sponges were collected by the Discovery expeditions at a relatively few pin-points of the Antarctic expanse, these 320,000,000 metric tons are probably barely sufficient to meet the demands of all silica-secreting organisms, sponges, radiolaria, etc. In fact, the assumption is more probable that, in addition, a fair proportion of the silica from the skeletons of dead sponges, and other organisms, may enter once again into circulation in the sea.

There is another point, from which no definite conclusions can be drawn, but the mention of which may be of interest. Among all the Antarctic collections represented in the British Museum, numerous examples may be found of accumulations of spicules into irregularly rounded masses, or balls (see Plate LVII, figs. 14–16). These are formed of the larger spicules of siliceous sponges, matted and felted together in compact masses up to 20 cm. in diameter: and their occurrence suggests that, indirectly, sponges may be the agents for a considerable amount of the segregation of silica necessary for the formation of chert and flint, in a manner hitherto unsuspected. There can be little doubt that these "spicule balls" are formed in much the same way as the balls of *Posidonia* fibres, by the action of waves, and it is probable that consideration of their presence in large numbers on the sea-bottom, taken in conjunction with the suggested continuous extrusion of sponge spicules during life (cf. Burton, *Proc. Zool. Soc. London*, 1931, p. 524) may be of importance in the study of cherts and their origin.

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[1] See Tarr, Univ. Missouri Studies, 1926, Vol. 1, No. 2, p. 2.

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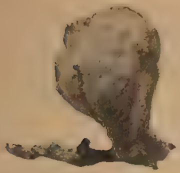
PLATE XLVIII

Fig. 1. *Pericharax pyriformis*, sp.n. Holotype. Nat. size.
Fig. 2. *Pericharax pyriformis*, sp.n. Co-type. Nat. size.
Fig. 3. *Leucettusa simplicissima*, sp.n. Holotype. Nat. size.
Fig. 4. *Hemigellius pachyderma*, sp.n. Holotype. × $\frac{2}{3}$.
Fig. 5. *Haliclona bilamellata*, sp.n. Holotype: showing outer surface. × $\frac{2}{3}$.
Fig. 6. *Haliclona bilamellata*, sp.n. Holotype: showing inner surface. × $\frac{2}{3}$.
Fig. 7. *Haliclona bilamellata*, sp.n. Portion of another specimen showing outer surface. × $\frac{2}{3}$.
Fig. 8. *Haliclona bilamellata*, sp.n. The same, from the inner surface. × $\frac{2}{3}$.
Fig. 9. *Haliclona bilamellata*, sp.n. A tubular specimen. × $\frac{2}{3}$.
Fig. 10. *Haliclonissa sacciformis*, sp.n. Holotype. × $\frac{1}{2}$.



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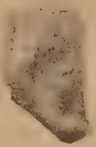

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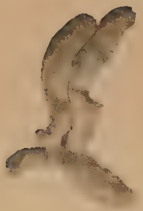

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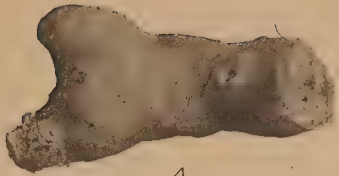

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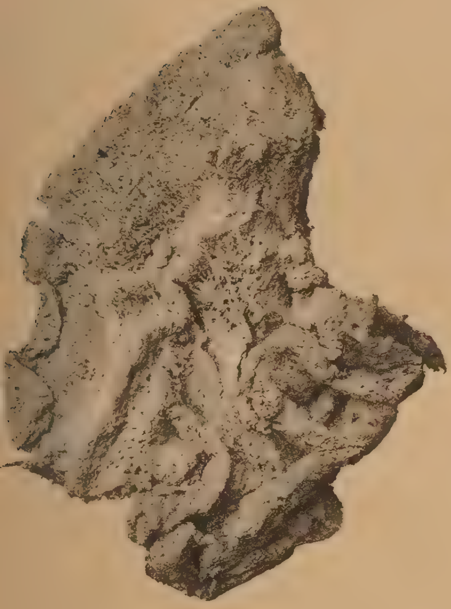

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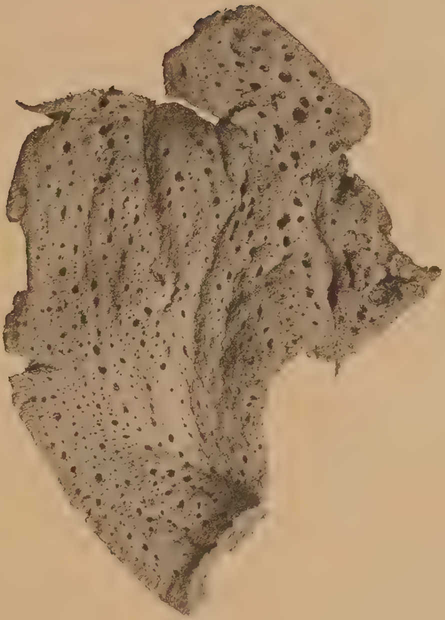

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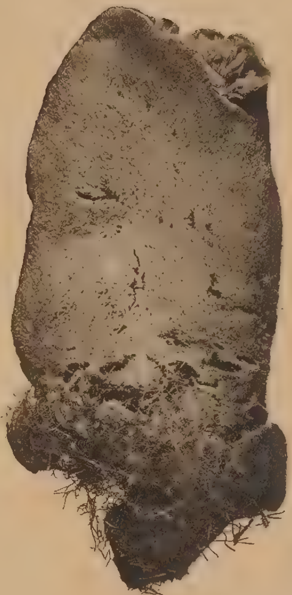

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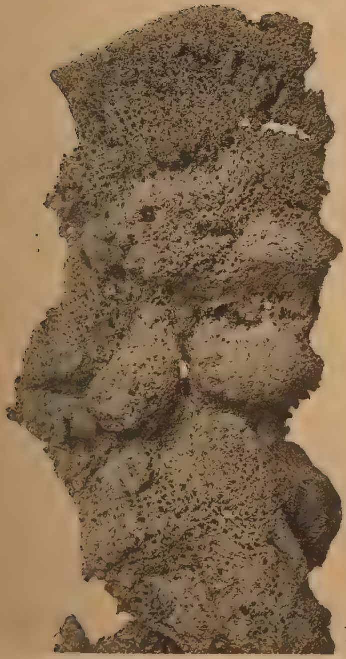

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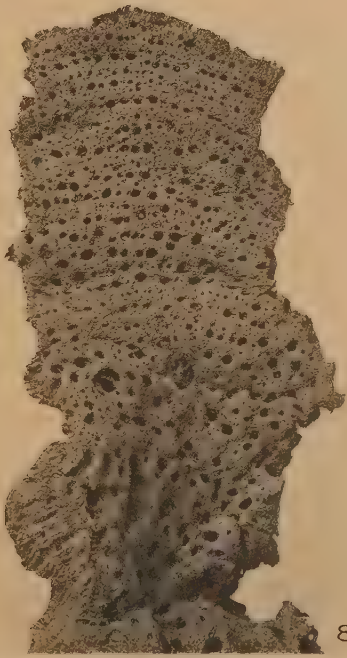

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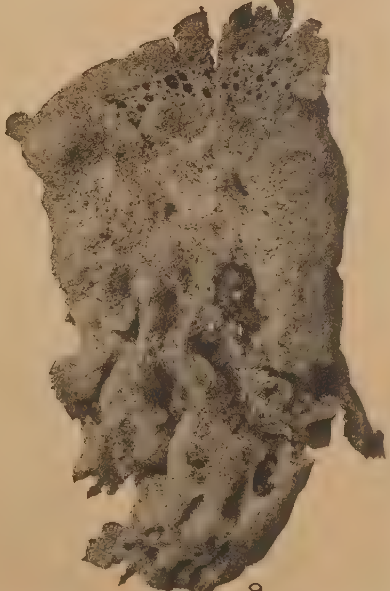

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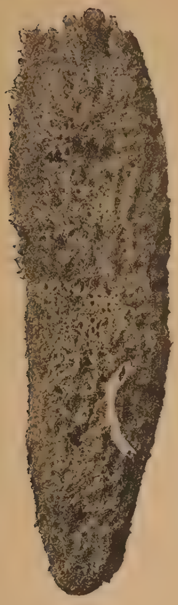
PLATE XLIX

Fig. 1. *Haliclona bilamellata*, sp.n. A tubular specimen. × ⅔.

Fig. 2. *Haliclona bilamellata*, sp.n. A flabellate specimen showing oscular surface. × ⅔.

Fig. 3. *Haliclona bilamellata*, sp.n. The same, showing poral surface. × ⅔.

Fig. 4. *Callyspongia flabellata*, sp.n. Holotype. × ⅔.



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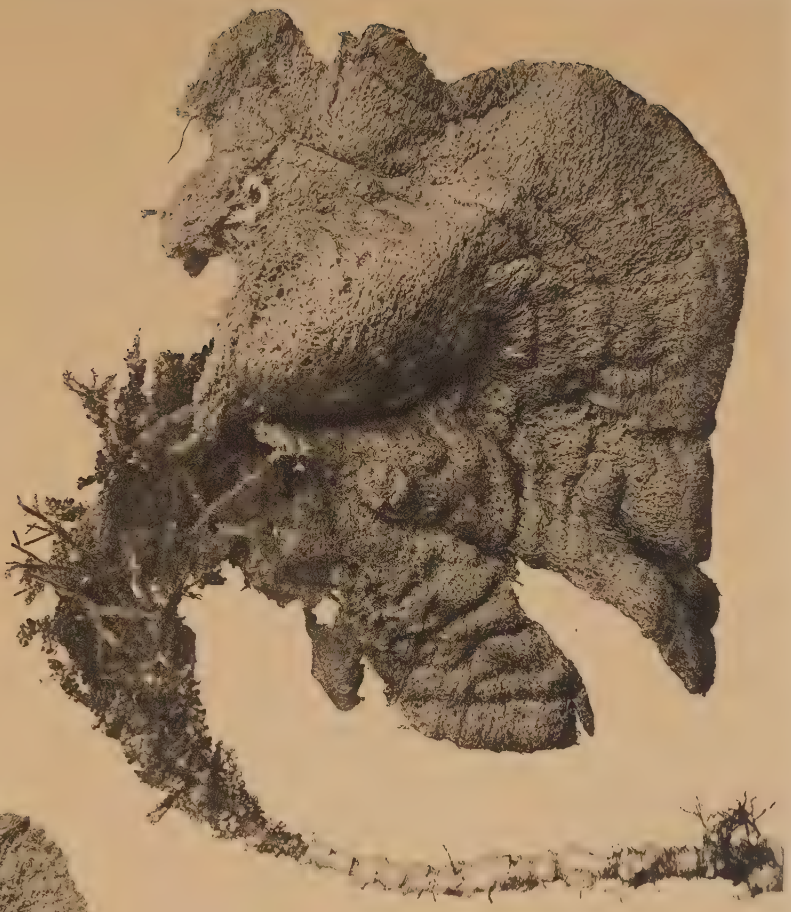

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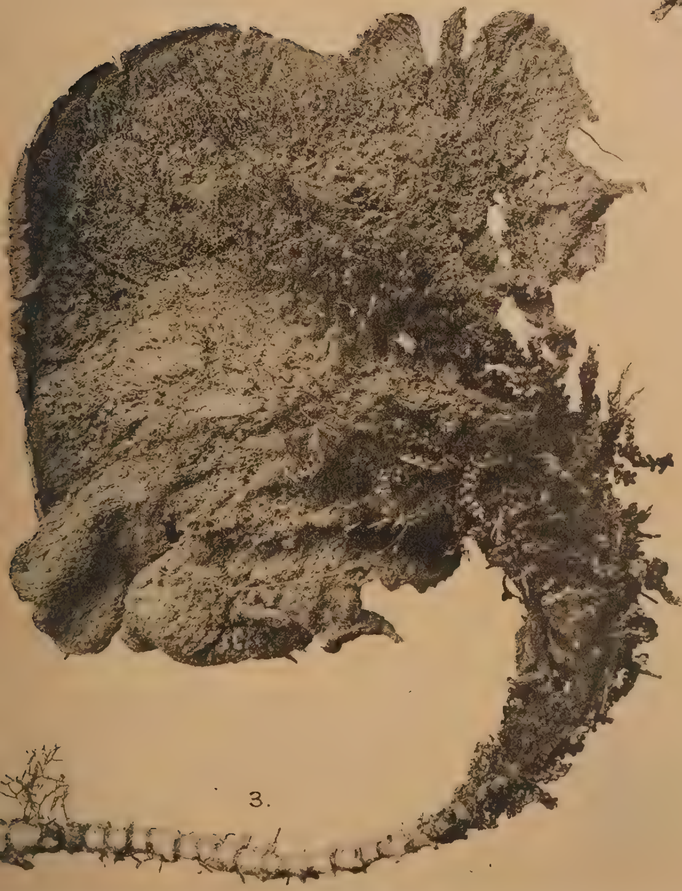

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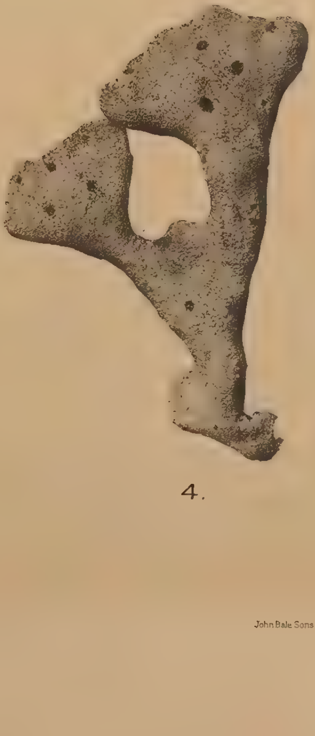

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ANTARCTIC SPONGES.

PLATE L

Fig. 1. *Microxina benedeni* (Topsent). × $\frac{1}{6}$.

Fig. 2. *Haliclona bilamellata*, sp.n. A macerated specimen, showing the fibrous appearance imparted to the skeleton when the spicules are large. × $\frac{2}{3}$.

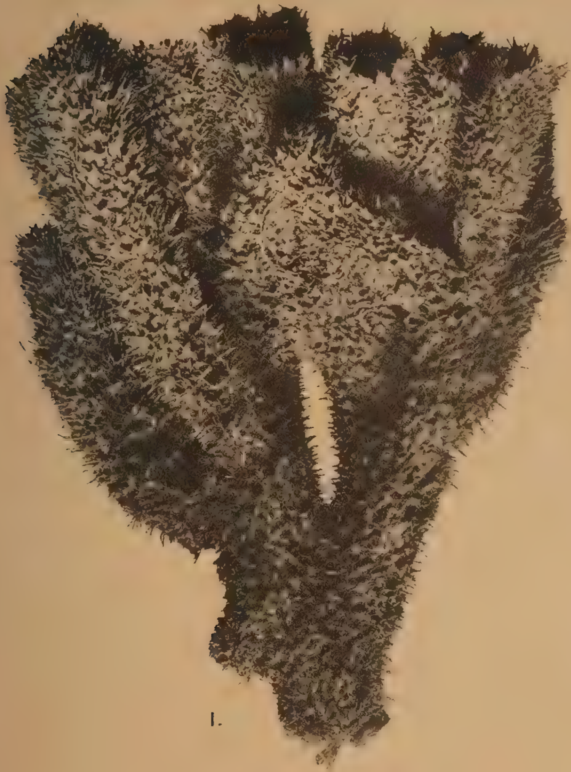
Fig. 3. *Dasychalina validissima* (Thiele). Portion of a sub-flabellate specimen. × $\frac{2}{3}$.

Fig. 4. *Dasychalina validissima* (Thiele). A massive specimen. × $\frac{2}{3}$.

Fig. 5. *Dasychalina validissima* (Thiele). A massive specimen. × $\frac{2}{3}$.

Fig. 6. *Dasychalina validissima* (Thiele). A flabellate specimen. × $\frac{2}{3}$.

Fig. 7. *Dasychalina validissima* (Thiele). A flabellate specimen. × $\frac{2}{3}$.



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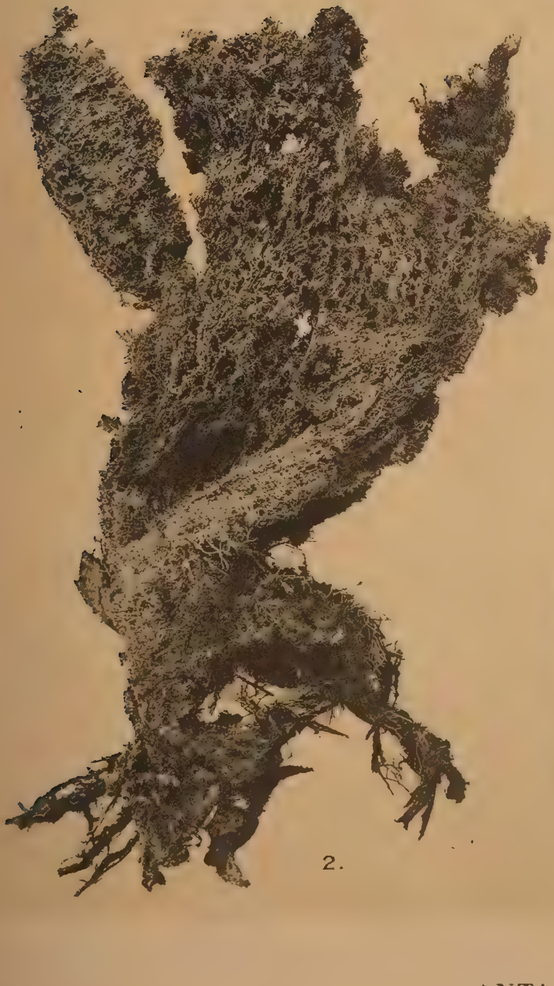

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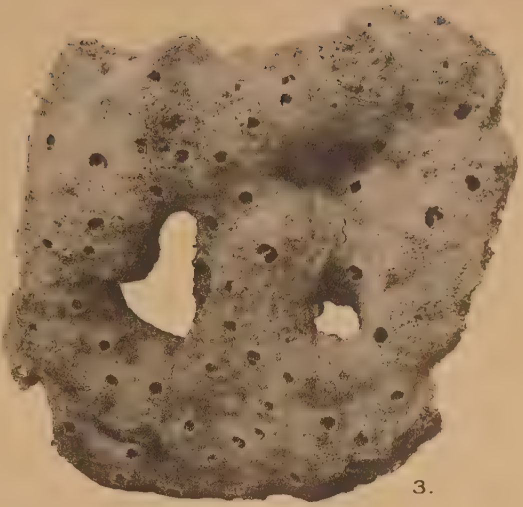

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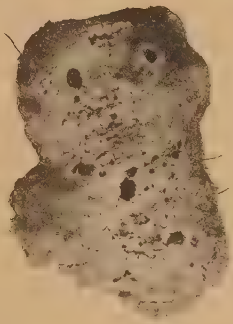

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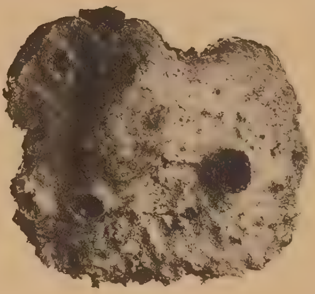

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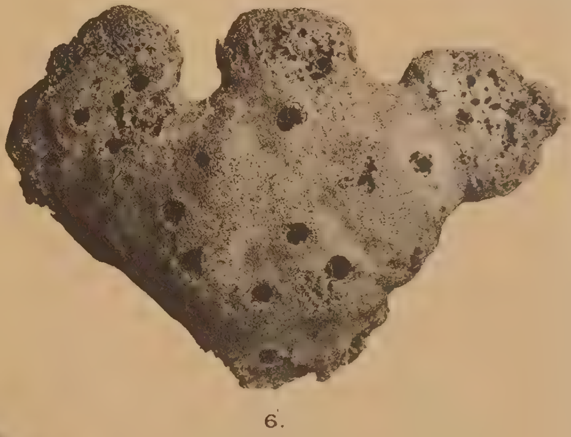

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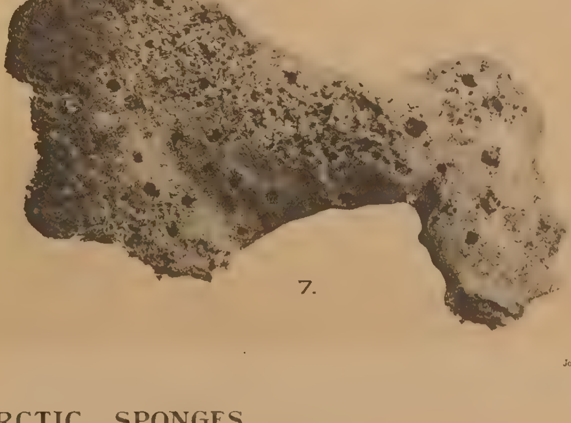

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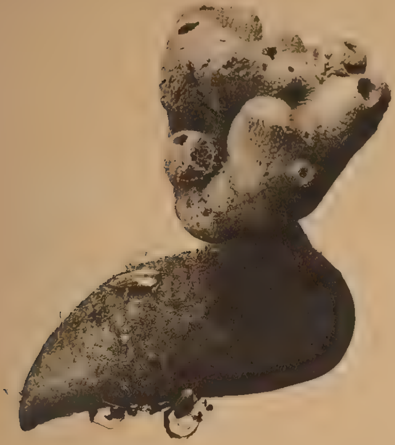
PLATE LI

Fig. 1. *Haliclona variabilis* (Thiele). Slightly less than natural size.
Fig. 2. *Haliclona variabilis* (Thiele). Natural size.
Fig. 3. *Haliclonissa verrucosa*, sp.n. Holotype. × $\frac{2}{3}$.
Fig. 4. *Isodictya antarctica* (Kirkpatrick). × $\frac{1}{6}$.
Fig. 5. *Isodictya microchela* (Topsent). × $\frac{2}{3}$.
Fig. 6. *Mycale macrochela*, sp.n. Holotype. × $\frac{2}{3}$.



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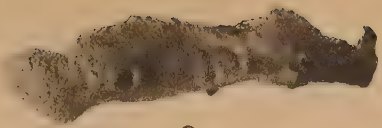

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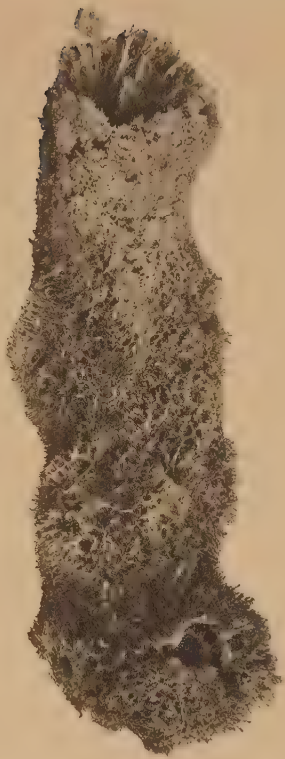

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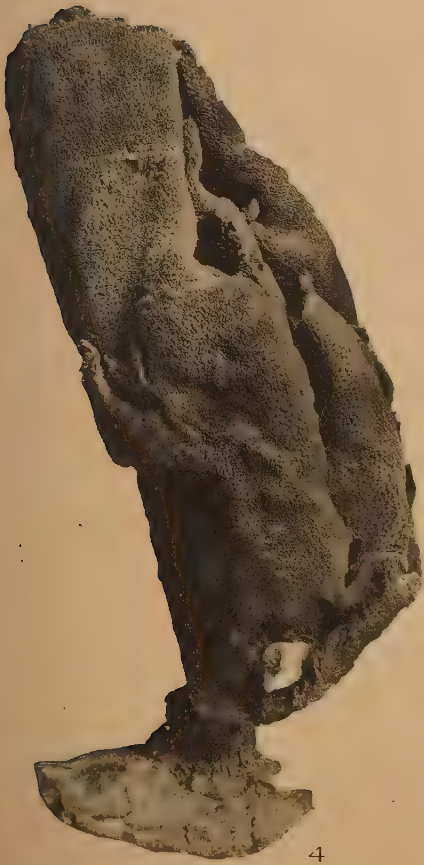

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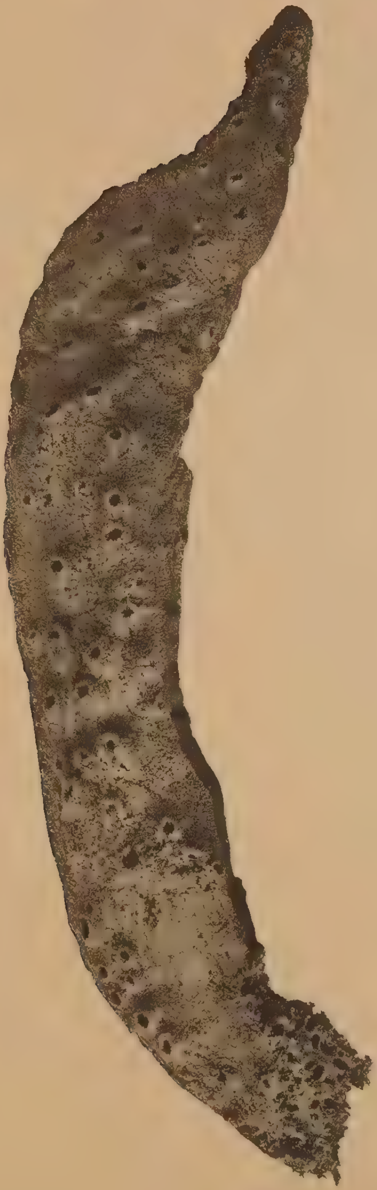

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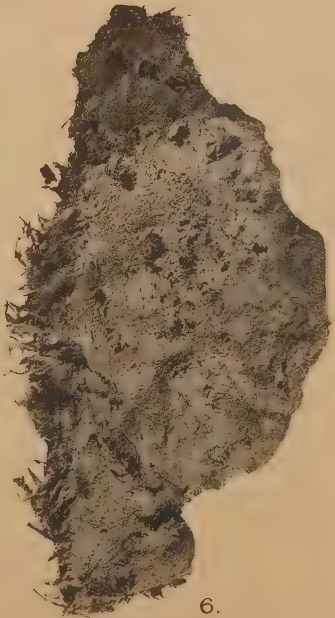

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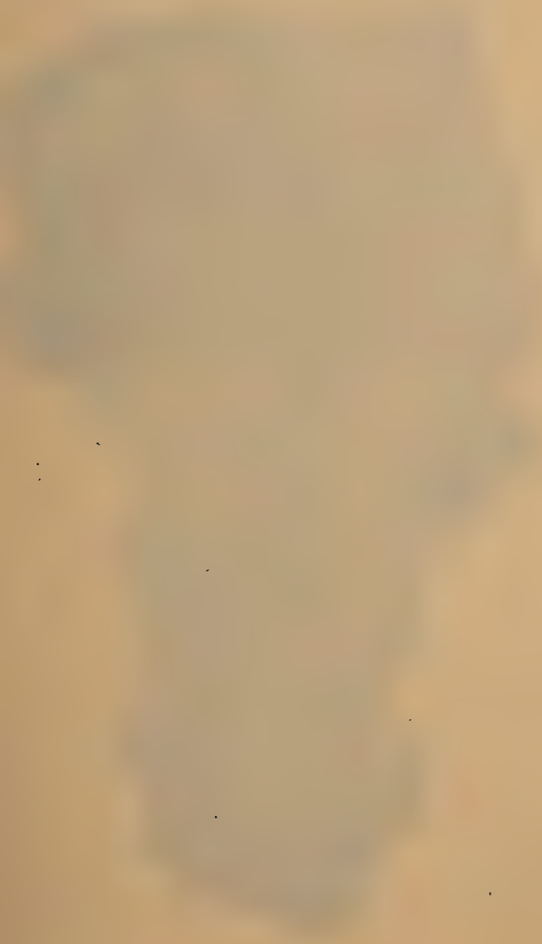
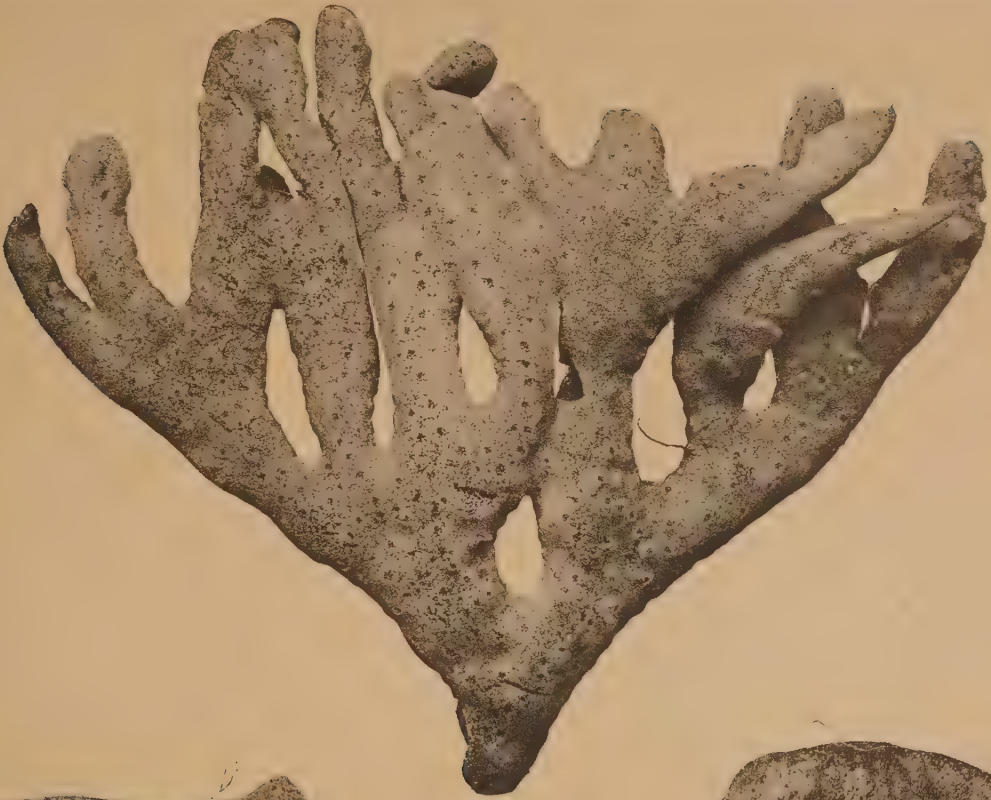


PLATE LII

Fig. 1. *Callyspongia fusifera* (Thiele). × $\frac{2}{3}$.
Fig. 2. *Isodictya toxophila*, sp.n. × $\frac{2}{3}$.
Fig. 3. *Isodictya toxophila*, sp.n. × $\frac{2}{3}$.



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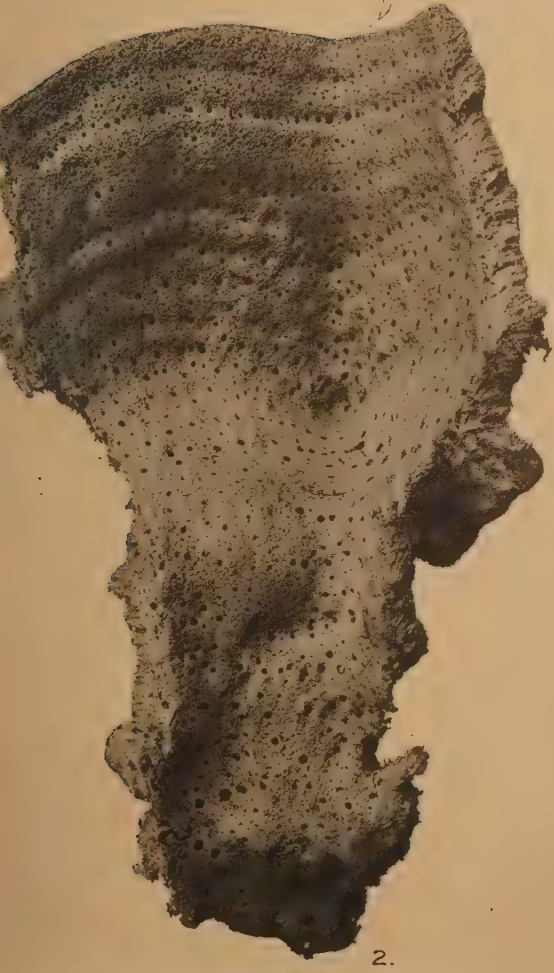

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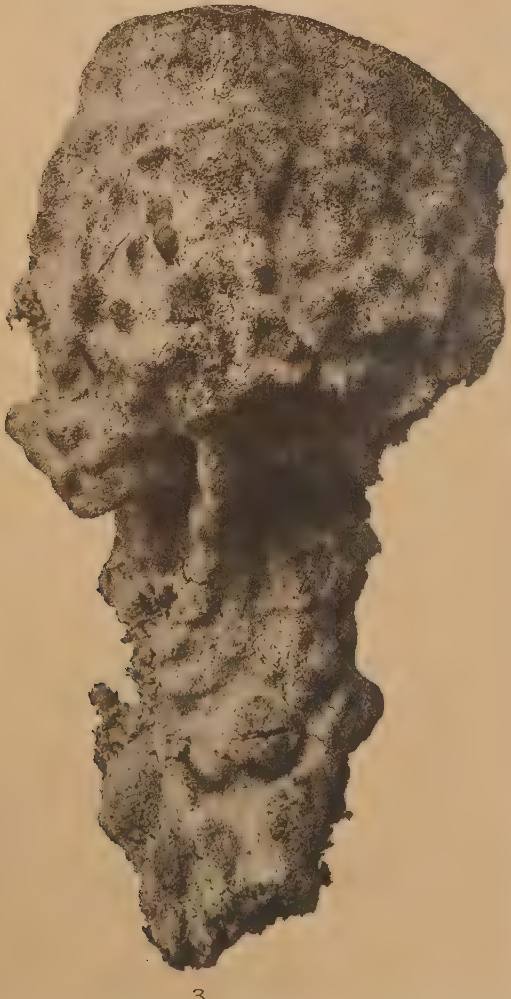

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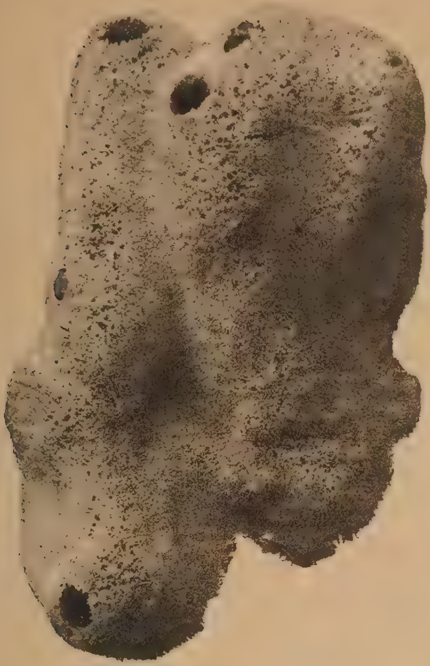
ANTARCTIC SPONGES.

PLATE LIII

Fig. 1. *Isodictya toxophila*, sp.n. × 1/1.
Fig. 2. *Isodictya toxophila*, sp.n. × 1/1.
Fig. 3. *Plumocolumella myxillioides*, sp.n. Holotype. × 2/3.
Fig. 4. *Plumocolumella myxillioides*, sp.n. × 2/3.
Fig. 5. *Amphilectus flabellata*, sp.n. × 2/3.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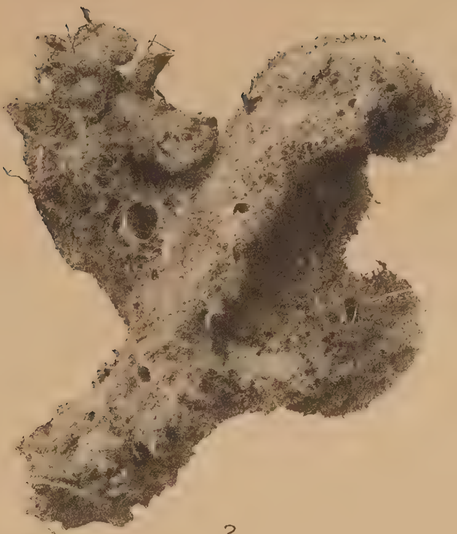
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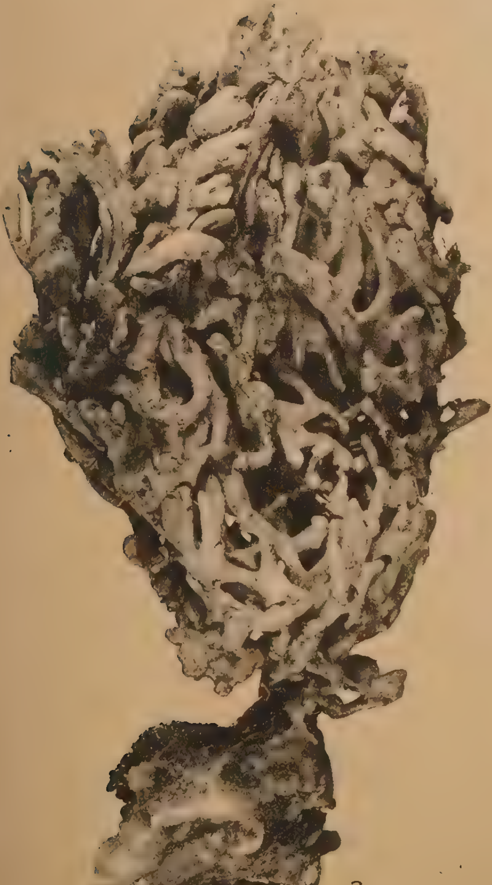
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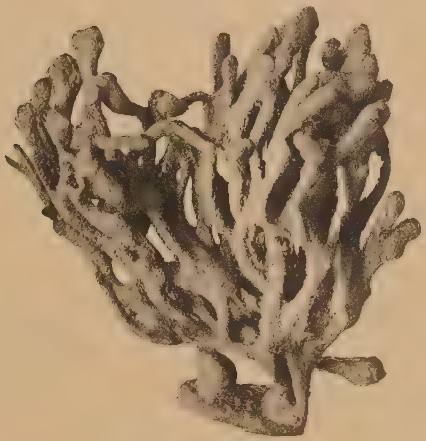
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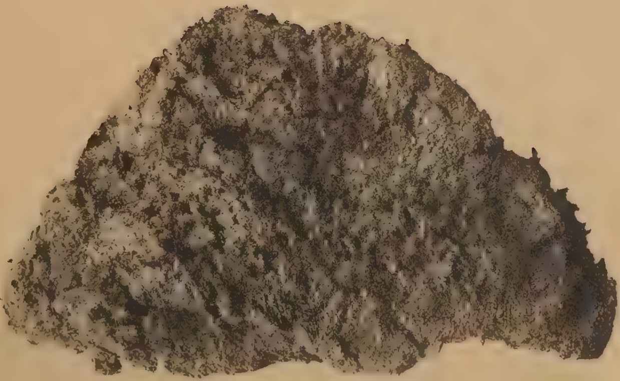
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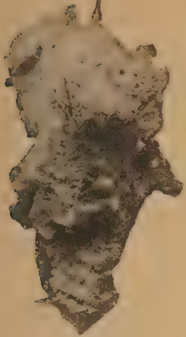
ANTARCTIC SPONGES.

PLATE LIV

Fig. 1. *Amphilectus fucorum* (Johnston). × $\frac{1}{1}$.
Fig. 2. *Amphilectus fucorum* (Johnston). × $\frac{2}{3}$.
Fig. 3. *Amphilectus fucorum* (Johnston). × $\frac{2}{3}$.
Fig. 4. *Amphilectus fucorum* (Johnston). × $\frac{1}{1}$.
Fig. 5. *Amphilectus edwardi*, var. *americana* (Ridley and Dendy). × $\frac{2}{3}$.
Fig. 6. *Myxilla australis* (Topsent). × $\frac{2}{3}$.
Fig. 7. *Acheliderma topsenti*, sp.n. × 1$\frac{1}{2}$.
Fig. 8. *Acheliderma topsenti*, sp.n. × 1$\frac{1}{2}$.
Fig. 9. *Acheliderma topsenti*, sp.n. × 1$\frac{1}{2}$.
Fig. 10. *Myxilla chilensis*, Thiele. × $\frac{2}{3}$.
Fig. 11. *Anchinoë leptochela* (Hentschel). × $\frac{1}{1}$.



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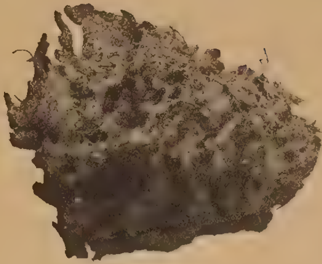

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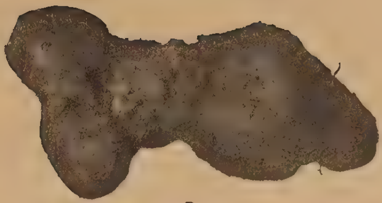

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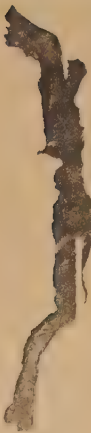

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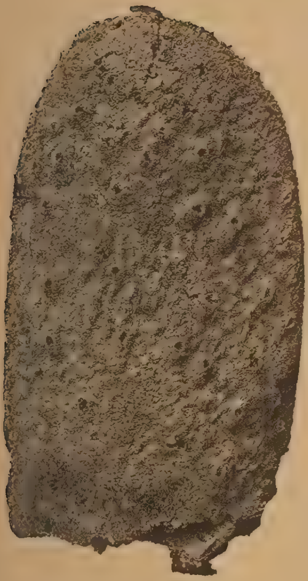

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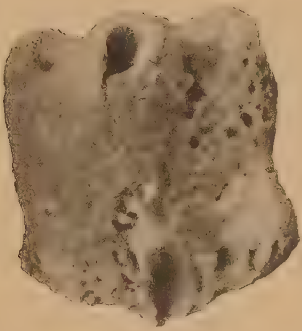

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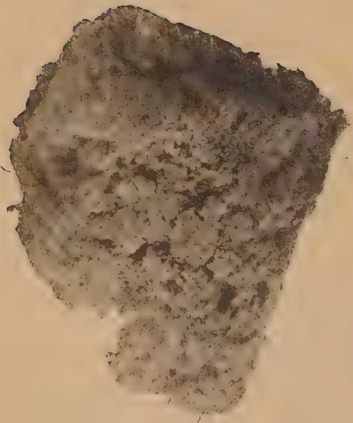

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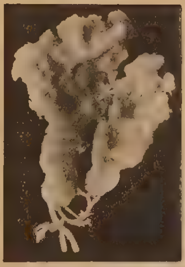

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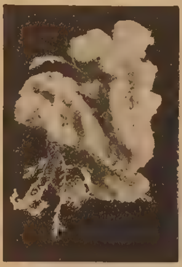

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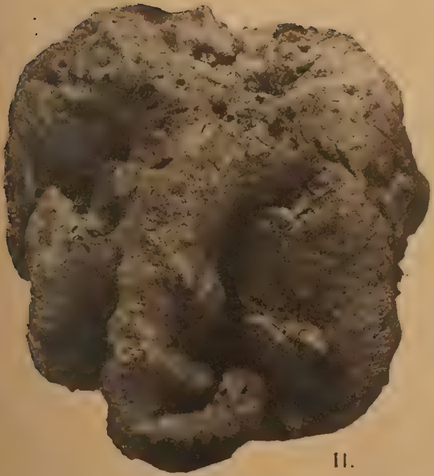

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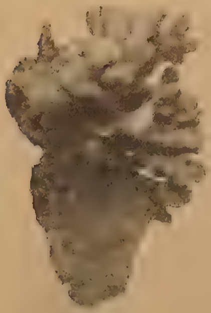

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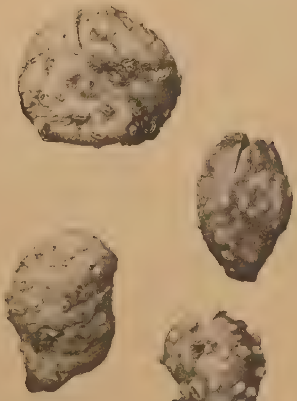

12.

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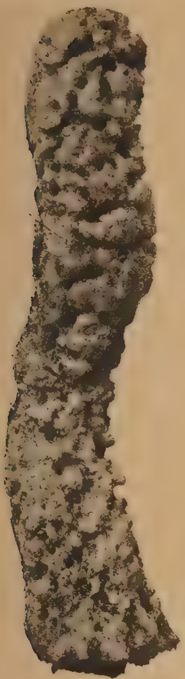
ANTARCTIC SPONGES.

PLATE LV

Fig. 1. *Myxilla mollis* (Ridley and Dendy). × $\frac{2}{3}$.
Fig. 2. *Myxilla mollis* (Ridley and Dendy). × $\frac{2}{3}$.
Fig. 3. *Myxilla mollis* (Ridley and Dendy). × $\frac{2}{3}$.
Fig. 4. *Myxilla mollis* (Ridley and Dendy). × $\frac{2}{3}$.
Fig. 5. *Kirkpatrickia coulmani* (Kirkpatrick). × $\frac{3}{4}$.
Fig. 6. *Clathria lipochela*, sp.n. × $\frac{2}{3}$.
Fig. 7. *Clathria lipochela*, sp.n. × $\frac{2}{3}$.
Fig. 8. *Ophlitaspongia thielei*, sp.n. × $\frac{1}{1}$.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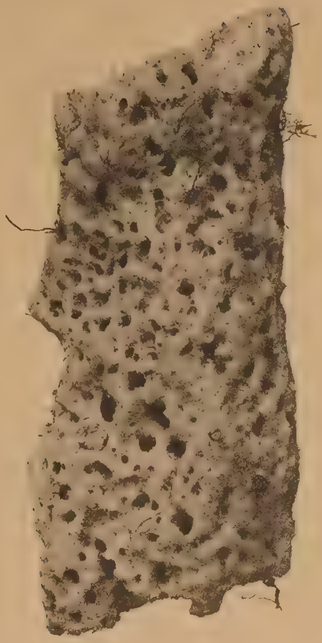
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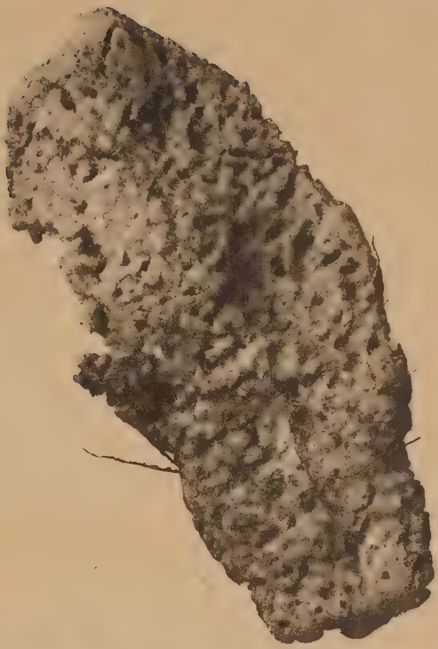
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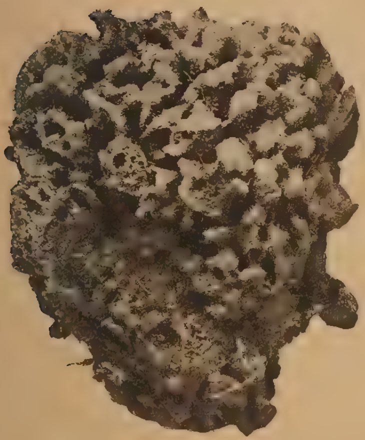
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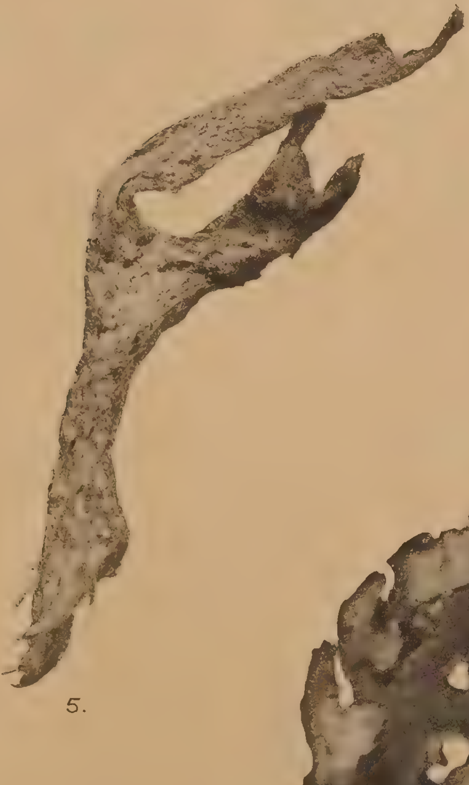
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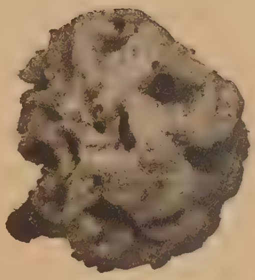
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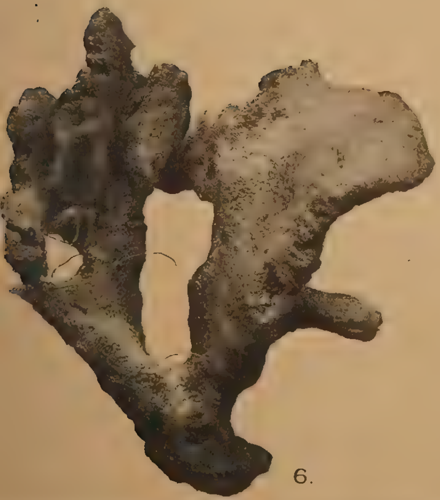
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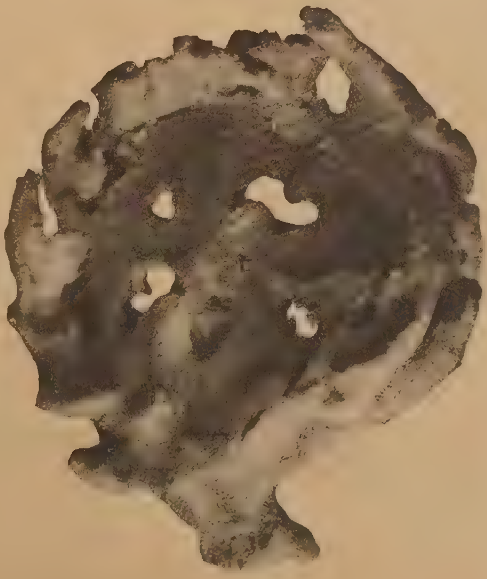
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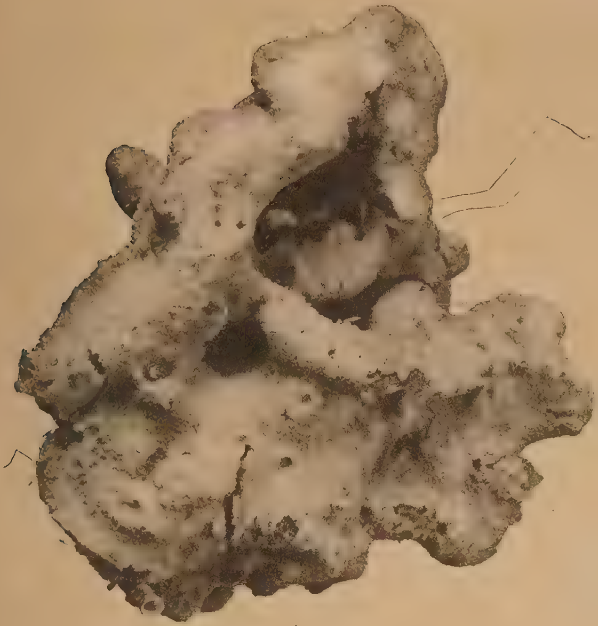
ANTARCTIC SPONGES.

PLATE LVI

Fig. 1. *Rhaphidophlus paucispiculus*, sp.n. Holotype. × $\frac{2}{3}$.
Fig. 2. *Protoclathria simplicissima*, sp.n. Holotype. × $\frac{1}{1}$.
Fig. 3. *Dictyociona discreta* (Thiele). A macerated specimen. × $\frac{2}{3}$.
Fig. 4. *Dictyociona discreta* (Thiele). × $\frac{1}{1}$.
Fig. 5. *Plicatellopsis arborescens*, gen. et sp.n. Holotype. × $\frac{2}{3}$.
Fig. 6. *Plicatellopsis flabellata*, gen. et. sp.n. Holotype. × $\frac{1}{4}$.
Fig. 7. *Spirastrella purpurea* (Lamarck). × $\frac{1}{1}$.
Fig. 8. *Duseideia tenuifibra*, sp.n. Holotype. × $\frac{1}{1}$.
Fig. 9. *Hymeniacidon dubia*, sp.n. Holotype. × $\frac{2}{3}$.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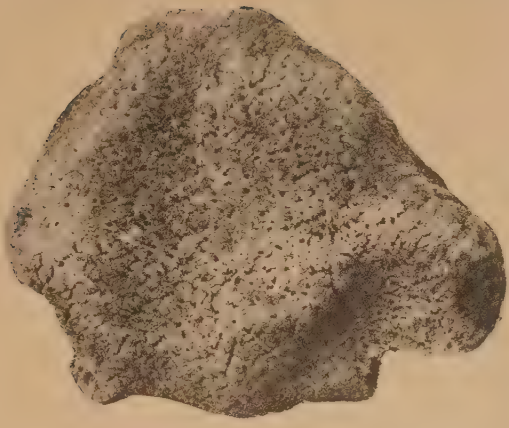
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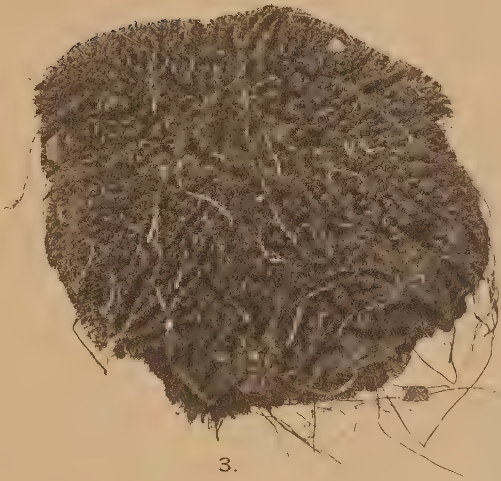
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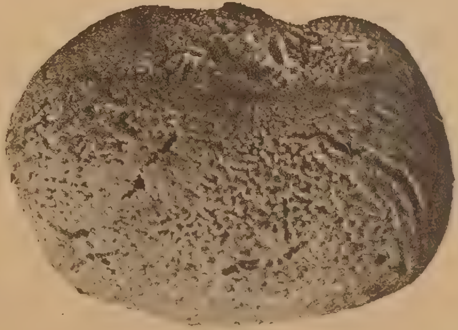
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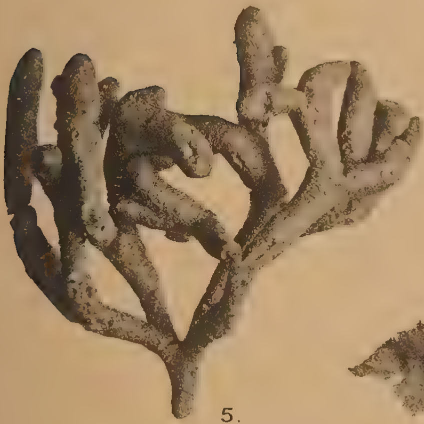
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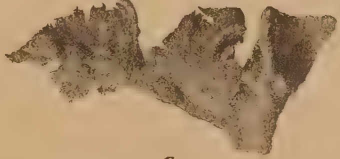
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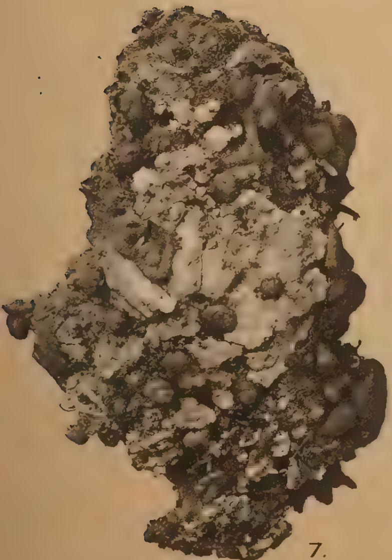
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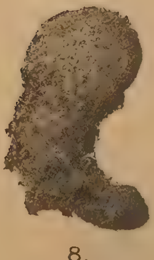
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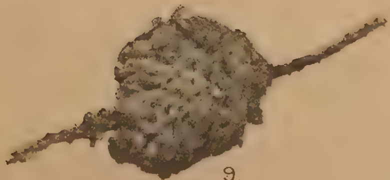
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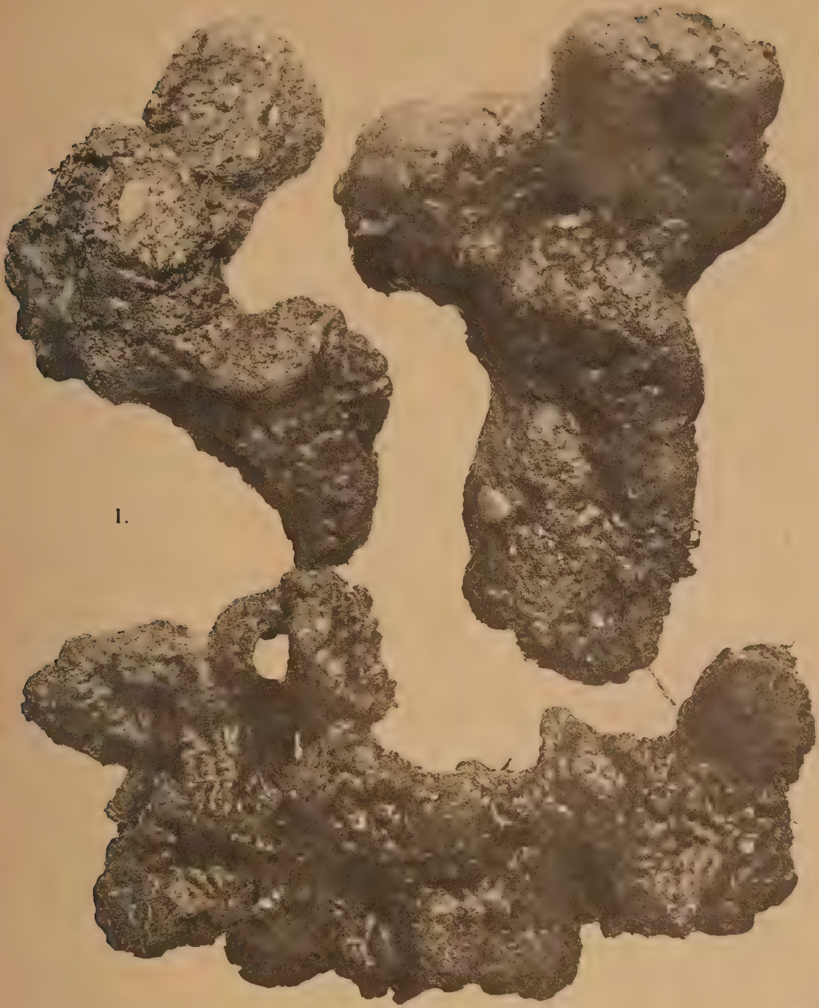
ANTARCTIC SPONGES.

PLATE LVII

Figs. 1–13. *Iophon proximum* (Ridley). 1 = D 257; 2–6 = D 251; 7–9 = D 740; 10 = D 258; 11 = D 255; 12–13 = D 430.

Figs. 14–16. Spicule balls.



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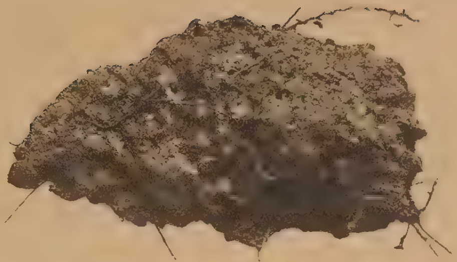

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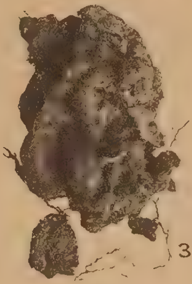

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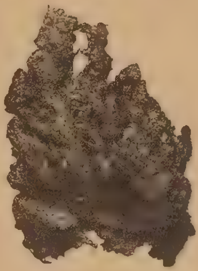

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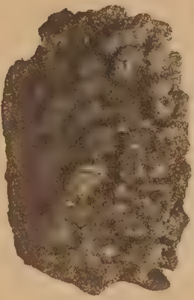

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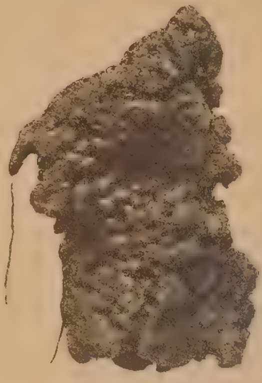

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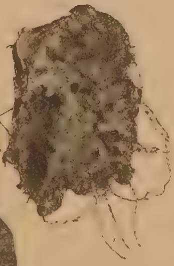

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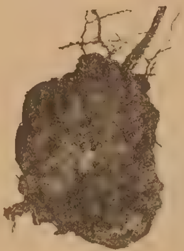

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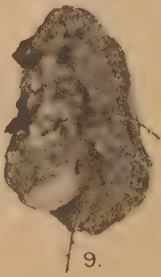

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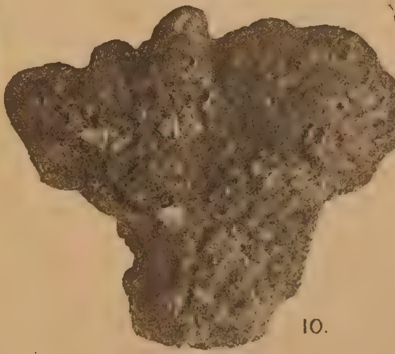

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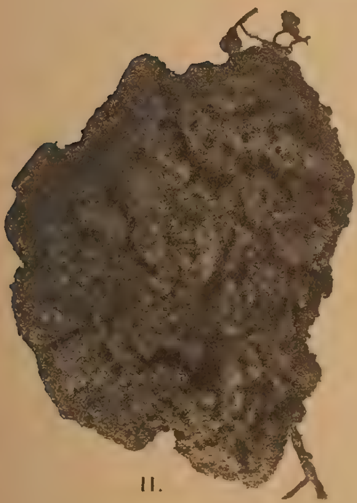

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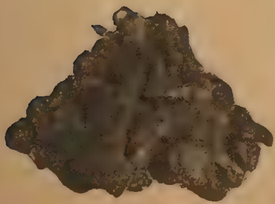

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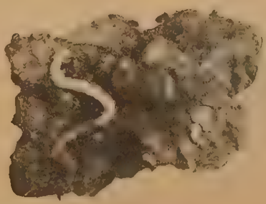

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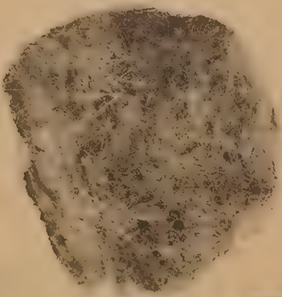

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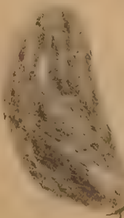

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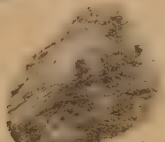

16.

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ANTARCTIC SPONGES.

[*Discovery Reports. Vol. VI, pp.* 393–418, *December*, 1932]

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A LIST OF WORMS PARASITIC IN CETACEA

By

H. A. BAYLIS, M.A., D.Sc.
Department of Zoology, British Museum (Natural History)

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Acanthocephala 405

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A LIST OF WORMS PARASITIC IN CETACEA

By H. A. Baylis, M.A., D.Sc.
Department of Zoology, British Museum (Natural History)

INTRODUCTION

THE compilation of a catalogue of the worm parasites of Cetacea was undertaken some time ago at the request of Dr Stanley Kemp, F.R.S., and of the Discovery Committee. The list now presented is, it is hoped, as complete as it is possible at the present time to make it, though our knowledge of many of the forms mentioned is very scanty, and the systematic position of some of them remains uncertain.

The catalogue is divided into three sections:

(1) A list of the parasites, in which are given their synonyms, references to the more important literature upon them, and the hosts from which they have been recorded. The parasites are here arranged, as far as possible, in systematic order, and are classified under their families, and these again under the headings of the four principal groups, Trematodes, Cestodes, Nematodes and Acanthocephala. No attempt has been made to give a complete bibliography for every species mentioned, but the works referred to include those in which descriptions of the species are given or their systematic position discussed, or in which references to further literature may be found. The date of publication follows the author's name, different publications in the same year being distinguished by the letters *a*, *b*, etc., following the date. Where the date is followed by a number, this is a page reference. The full references will be found by turning to the bibliography in the third section.

(2) A list of the hosts, with the parasites recorded from each. In this section the names of the hosts are arranged alphabetically, and their principal synonyms and vernacular names, when known, are given. The names of the parasites are again arranged systematically.

(3) A bibliography, arranged in the alphabetical order of the authors' names.

The writer is greatly indebted to Sir Sidney F. Harmer, F.R.S., for very kindly checking the names and synonyms of the hosts. The synonymy of many of the Cetacea is extremely involved, and it is sometimes impossible to be certain what species of whale is meant by authors who have recorded parasites from these animals.

CLASSIFIED LIST OF PARASITES, WITH SYNONYMS, REFERENCES TO LITERATURE, AND HOSTS

TREMATODES

Family HETEROPHYIDAE

Galactosomum erinaceum (Poirier, 1886), Nicoll, 1923.

Synonyms: *Distomum erinaceum*, Poirier, 1886; *D.* (*Dicrocoelium*) *erinaceum*, Stossich, 1892; *Astiotrema erinacea*, Stossich, 1904.

References: Poirier, 1886, 37; Stossich, 1892, 22; 1904, 2; Looss, 1899, 590; Nicoll, 1923, 240, 244; Price, 1932, 40.

Recorded from the intestine of *Delphinus delphis* (in cysts).

Family OPISTHORCHIDAE

Opisthorchis tenuicollis (Rud., 1819), Stiles and Hassall, 1896.

Reference: Price, 1932, 26 (*q.v.* for synonyms).

Recorded, according to Price, from the bile ducts of *Phocaena phocaena*.

Amphimerus lancea (Dies., 1850), Barker, 1911.

Synonyms: *Distomum lancea*, Diesing, 1850; *D.* (*Dicrocoelium*) *lancea*, Stossich, 1892; *Opisthorchis lancea*, Braun, 1901.

References: Diesing, 1850, 334; 1855, 64; v. Beneden, 1870, 362; Cobbold, 1876, 35; 1879, 416; Stossich, 1892, 26; Weski, 1900, 579; Braun, 1901, 897; Price, 1932, 29.

Recorded from the liver of *Orcella brevirostris*, *Sotalia tucuxi*.

Cyclorchis campula (Cobbold, 1876), Lühe, 1908.

Synonyms: *Distoma campula*, Cobbold, 1876; *Campula oblonga*, Cobbold, 1876, *nec* Cobbold, 1858; *Opisthorchis campula*, Looss, 1899; *Metorchis campula*, Looss, 1899.

References: Cobbold, 1876, 40; Looss, 1899, 559, 565; Lühe, 1908, 432; Price, 1932, 28.

Recorded from the bile ducts of *Platanista gangetica*.

Family TROGLOTREMATIDAE

Pholeter gastrophilus (Kossack, 1910), Odhner, 1914.

Synonym: *Distomum gastrophilum*, Kossack, 1910.

References: Kossack, 1910, 118; Odhner, 1914, 233; Price, 1932, 24.

Recorded from the stomach of *Phocaena phocaena* (in cysts).

Family FASCIOLIDAE, sub-family *CAMPULINAE* (=CAMPULIDAE, Fuhrm.)

Campula oblonga, Cobbold, 1858, of Braun, 1900.

Synonyms: *Campula oblonga*, Cobbold, 1858, *nec* Cobbold, 1876; *Distomum oblongum*, Braun, 1891; *D.* (*Brachylaimus*) *oblongum*, Stossich, 1892; *Distomum tenuicolle*, Olsson, 1893; *Opisthorchis oblonga*, Kowalevsky, 1898; *Brachycladium oblongum*, Looss, 1902.

References: Cobbold, 1858, 168; 1879, 419; Stossich, 1892, 16; Monticelli, 1893, 44; Stiles, 1895, 219; Looss, 1899, 558, etc.; 1902, 716; Braun, 1900, 249; Price, 1932, 7.

Recorded from the bile ducts of *Phocaena phocaena.*

Campula delphini (Poirier, 1886), Bittner and Sprehn, 1928.

Synonyms: *Distomum delphini*, Poirier, 1886; *Cladocoelium delphini*, Stossich, 1892; *Brachycladium delphini*, Looss, 1899.

References: Poirier, 1886, 34; Stossich, 1892, 10; Monticelli, 1893, 44 *et passim*; Stiles, 1895, 219; Looss, 1899, 558; Odhner, 1905, 348.

Recorded from the liver of *Delphinus delphis.*

Campula palliata (Looss, 1885), Looss, 1901.

Synonyms: *Distomum palliatum*, Looss, 1885; *Cladocoelium palliatum*, Stossich, 1892; *Brachycladium palliatum*, Looss, 1899.

References: Looss, 1885, 390; 1899, 556; 1901, 208; Stossich, 1892, 10; Monticelli, 1893, 27 *et passim*; Stiles, 1895, 219; Odhner, 1905, 341, etc.; Price, 1932, 9.

Recorded from the bile ducts of *Delphinus delphis.*

Campula rochebruni (Poirier, 1886), Bittner and Sprehn, 1928.

Synonyms: *Distomum rochebruni*, Poirier, 1886; *Cladocoelium rochebruni*, Stossich, 1892; *Brachycladium rochebruni*, Looss, 1899.

References: Poirier, 1886, 36; Stossich, 1892, 11; Monticelli, 1893, 44, etc.; Stiles, 1895, 219; Looss, 1899, 558; Odhner, 1905, 344, etc.; Price, 1932, 11.

Recorded from the liver of *Delphinus delphis.*

Lecithodesmus goliath (v. Beneden, 1858), Braun, 1902.

Synonym: *Distomum goliath*, v. Beneden, 1858.

References: v. Beneden, 1858, 95; Diesing, 1858, 336; Stossich, 1892, 34; Braun, 1902, 800; Odhner, 1905, 344; Price, 1932, 12.

Recorded from the liver of *Balaena mysticetus*, *Balaenoptera borealis*, *B. acutorostrata.*

Synthesium tursionis (Marchi, 1873), Stunkard and Alvey, 1930.

Synonyms: *Distomum tursionis*, Marchi, 1873; *D. longissimum*, Poirier, 1886; *D.* (*Dicrocoelium*) *longissimum*, Stossich, 1892; *D.* (*Dicrocoelium*) *tursionis*, Parona, 1896; *Fasciolopsis* (?) *tursionis*, Nicoll, 1923.

References: Marchi, 1873, 304; Poirier, 1886, 29; Stossich, 1892, 37; Nicoll, 1923, 238; Stunkard and Alvey, 1930, 332; Price, 1932, 16.

Recorded from the intestine of *Tursiops truncatus.*

Hadwenius seymouri, Price, 1932.

Reference: Price, 1932, 18.

Recorded from the intestine of *Delphinapterus leucas.*

Family NOTOCOTYLIDAE

Ogmogaster plicatus (Creplin, 1829), Jägerskiöld, 1891.

Synonym: *Monostomum plicatum*, Creplin, 1829.

References: Creplin, 1829, 878; Diesing, 1850, 324; v. Beneden, 1870, 357; Cobbold, 1879, 421; Jägerskiöld, 1891 *a*; 1891 *b*, 129; Brandes, 1892, 509; Monticelli, 1892 *b*, 696, etc.; Odhner, 1905, 366; Leiper and Atkinson, 1915, 37; Hamilton, 1916, 131; Price, 1932, 45.

Recorded from the intestine of *Balaenoptera acutorostrata*, *B. borealis*, *B. musculus*, *B. physalus*.

UNCLASSIFIED FORMS

Distoma andersoni, Cobbold, 1876.

Synonym: *Distomum* (*Brachylaimus*) *andersoni*, Stossich, 1892.

References: Cobbold, 1876, 46; 1879, 420; Stossich, 1892, 19; Price, 1932, 56.

Recorded from the small intestine of *Platanista gangetica*.

Distomum pallasii, Poirier, 1885.

Synonym: *D.* (*Dicrocoelium*) *pallasii*, Stossich, 1892.

References: Poirier, 1885, 477; Stossich, 1892, 27.

Recorded from the stomach of *Phocaena phocaena*.

Distomum philocholum, Creplin, 1845.

Reference: Creplin, 1845, 330.

Recorded from the liver of *Phocaena phocaena* (see Nicoll, 1923, 243. According to Price, 1932, 56, the host is *Delphinus delphis*.)

Distomum validum, v. Linstow, 1886.

Synonym: *D.* (*Brachylaimus*) *validum*, Stossich, 1892.

References: v. Linstow, 1886, 124; Stossich, 1892, 15.

Recorded from the stomach of *Delphinus* sp.

Monostomum delphini, Diesing, 1850.

Synonyms: *Monostomum blainvillei*, Cobbold, 1860; *Monostomulum delphini*, Brandes, 1892; *Agamodistomum delphini*, Price, 1932.

References: de Blainville, 1825, 141; Diesing, 1850, 330; Cobbold, 1860, 39; 1879, 421; v. Beneden, 1870, 358; Monticelli, 1892 *b*, 711; Brandes, 1892, 510; Price, 1932, 57.

Recorded from the blubber of "*Delphinus dalei* spec. affin."[1] (in cyst).

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[1] From information kindly supplied by Sir Sidney Harmer, F.R.S., it appears that the whale here referred to was probably either *Hyperoodon rostratus* or *Mesoplodon bidens*.

CESTODES

Family DIPHYLLOBOTHRIIDAE

Diphyllobothrium stemmacephalum, Cobbold, 1858.

Synonyms: *Dibothrium stemmacephalum*, Diesing, 1863; *Bothriocephalus stemmacephalus*, Braun, 1883.

References: Cobbold, 1858, 167; 1879, 105, 422; Diesing, 1863, 239; Stiles and Hassall, 1899, 170; Scott, 1909, 88; Baer, 1932, 214.

Recorded from the intestine of *Delphinus delphis*, *Phocaena phocaena*.

Diplogonoporus balaenopterae, Lönnberg, 1892.

References: Lönnberg, 1892, 4; Lühe, 1899, 50; Ariola, 1900, 385; Baer, 1932, 214.

Recorded from the intestine of *Balaenoptera borealis*.

Family PHYLLOBOTHRIIDAE

Phyllobothrium delphini (Bosc, 1802), Gervais, 1885.

Synonyms: *Hydatis delphinii*, Bosc, 1802; *Cysticercus delphini*, Laennec, 1804; *Cysticercus delphini*, Rudolphi, 1810; *Vermis delphini delphis*, Rud., 1810; *Cephalocotyleum delphini delphis*, Diesing, 1850; ?*Cysticercus physeteris*, Dies., 1863 (*vide Phyllobothrium physeteris*, *infra*).

References: Bosc, 1802, 1, 324; Laennec, 1804, 136; Rudolphi, 1810, 236, 265; Diesing, 1850, 493; 1863 *b*, 423; v. Beneden, 1870, 360; Cobbold, 1879, 422; Moniez, 1880, 117; Gervais, in Carus, 1885, 114; Linton, 1905, 820; Stiles and Hassall, 1912, 171; Southwell and Prashad, 1920, 2; Baer, 1932, 219.

Recorded from the blubber of *Delphinus delphis*, *Grampus griseus*, *Tursiops truncatus*.

Phyllobothrium inchoatum, Leidy, 1891.

(Possibly identical with *P. lactuca*, v. Beneden, 1850.)

References: Leidy, 1891, 418; Southwell and Prashad, 1920, 2; Southwell, 1925, 152.

Recorded from the blubber of *Mesoplodon bidens*.

Phyllobothrium physeteris (Dies., 1863), Meggitt, 1924.

(Possibly identical with *P. delphini* (Bosc).)

Synonyms: *Cysticercus balaenae mysticeti*, Diesing, 1850; *Cysticercus physeteris*, Diesing, 1863

References: Diesing, 1850, 493; 1863 *b*, 423; v. Beneden, 1870, 348; Cobbold, 1879, 421; Moniez, 1880, 117; Meggitt, 1924, 156.

Recorded from the blubber and skin of *Balaena mysticetus*, *Physeter catodon*.

Phyllobothrium sp. "(Carnot, 1822)," Meggitt, 1924.

References: Cobbold, 1879, 421; Meggitt, 1924, 157.

Recorded from the nasal sinus of *Tursiops truncatus*.

Phyllobothrium, sp., Linton, 1905.

Reference: Linton, 1905, 819.

Recorded from the mesentery of *Lagenorhynchus acutus*.

Monorygma chamissonii (Linton, 1905), Meggitt, 1924.

(Possibly identical with *M. grimaldii*, *vide infra*.)

Synonyms: *Taenia chamissonii*, Linton, 1905; ? *Cysticercus delphini*, Rudolphi, 1819, *nec* 1810.

References: Linton, 1905, 819; Meggitt, 1924, 152; Baylis, 1926 *b*, 667.

Recorded from the blubber and mesentery of *Lagenorhynchus acutus*.

Monorygma delphini (Gervais, 1870), Meggitt, 1924.

Synonym: *Stenotaenia delphini*, Gervais, 1870.

References: Gervais, 1870, 779; Baylis, 1919, 417; 1926 *b*, 667; Meggitt, 1924, 152.

Recorded from the diaphragm of *Delphinus delphis*.

Monorygma grimaldii (Moniez, 1889), Meggitt, 1924.

Synonyms: *Taenia Grimaldii*, Moniez, 1889; *Cysticercus Taeniae Grimaldii*, Moniez, 1889; *Cysticercus grimaldii*, Braun, 1898.

References: Moniez, 1889, 825; Braun, 1898, 1558; Baylis, 1919, 417; 1926 *b*, 665; Meggitt, 1924, 152.

Recorded from the blubber of *Lagenorhynchus acutus*, *Kogia breviceps*, (?) *Delphinus delphis*.

Scolex delphini, Stossich, 1898.

Reference: Stossich, 1898, 8.

Recorded from the rectum of *Grampus griseus*.

Family TETRABOTHRIIDAE

Tetrabothrius affinis (Lönnberg, 1891), Lönnberg, 1892.

Synonyms: *Diplobothrium affine*, Lönnberg, 1891; *Tetrabothrium* (*Diplobothrium*) *affine*, Lönnberg, 1892.

References: Lönnberg, in Jägerskiöld, 1891 *b*, 130, etc.; Lönnberg, 1892, 16; Baylis, 1926 *a*, 163; Baer, 1932, 196.

Recorded from the intestine of *Balaenoptera borealis*, *B. musculus*.

Tetrabothrius forsteri (Krefft, 1871), Johnston, 1912.

Synonyms: *Taenia forsteri*, Krefft, 1871; *Prosthecocotyle forsteri*, Monticelli, 1892; *Tetrabothrium triangulare*, Leidy, 1892, *nec* Diesing, 1850.

References: Krefft, 1871, 218; Cobbold, 1879, 422; Monticelli, 1892, 6; Fuhrmann, 1898, 386, etc.; 1899 *a*, 181; 1899 *b*, 865, 869; Johnston, 1912, 13; Linton, 1923, 52; Baylis, 1926 *a*, 169; Baer, 1932, 197.

Recorded from the intestine of *Delphinus delphis*, *Mesoplodon bidens*, *Steno rostratus*.

Tetrabothrius ruudi, Nybelin, 1928.

Reference: Nybelin, 1928, 312.

Recorded from the intestine of *Balaenoptera physalus*.

Tetrabothrius wilsoni (Leiper and Atkinson, 1914), Baylis, 1926.

Synonym: *Oriana wilsoni*, Leiper and Atkinson, 1914.

References: Leiper and Atkinson, 1914, 225; 1915, 46; Baylis, 1926 *a*, 168; Baer, 1932, 198.

Recorded from the intestine of *Balaenoptera borealis*.

Priapocephalus grandis, Nybelin, 1922.

References: Nybelin, 1922, 194; Baylis, 1926 *a*, 161; Baer, 1932, 205.

Recorded from the intestine of *Balaenoptera borealis*, *B. musculus*, "*Balaena antarctica*".

Priapocephalus minor, Nybelin, 1928.

Reference: Nybelin, 1928, 309.

Recorded from the intestine of *Balaenoptera borealis*.

Strobilocephalus triangularis (Dies., 1850), Baer, 1932.

Synonyms: *Tetrabothrium triangulare*, Diesing, 1850; *Prosthecocotyle triangulare*, Fuhrmann, 1899; *Tetrabothrius triangularis*, Fuhrmann, 1903.

References: Diesing, 1850, 601; 1863 *a*, 255; v. Beneden, 1870, 362; Cobbold, 1879, 422; Leidy, 1891, 417; Fuhrmann, 1899 *a*, 183; 1899 *b*, 865, etc.; Linton, 1923, 52; Joyeux and Dollfus, 1931, 112; Baer, 1932, 202.

Recorded from the intestine of *Delphinus* sp., *Hyperoodon rostratus*, *Lagenorhynchus acutus*.

Trigonocotyle monticellii (Linton, 1923), Baer, 1932.

Synonym: *Prosthecocotyle monticellii*, Linton, 1923, *nec* Fuhrmann, 1899.

References: Linton, 1923, 52; Baylis, 1926 *a*, 169, 170; Baer, 1932, 199.

Recorded from the intestine of *Globicephala melaena*.

NEMATODES

Family ASCARIDAE

Anisakis catodontis, Baylis, 1929.

Reference: Baylis, 1929, 544.

Recorded from the stomach of *Physeter catodon*.

Anisakis dussumierii (v. Beneden, 1870), Baylis, 1920.

Synonyms: *Ascaris* (*Anisakis*) *simplex* of Dujardin, 1845, *nec* Rudolphi, 1809; *Ascaris dussumierii*, van Beneden, 1870.

References: Dujardin, 1845, 220; v. Beneden, 1870, 362; Cobbold, 1879, 426; Stiles and Hassall, 1899, 161 *et passim*; Stossich, 1896, 17; Baylis, 1920 *b*, 260; 1923 *a*, 216.

Recorded from the intestine of *Delphinus* sp.

Anisakis insignis (Dies., 1851), Baylis, 1920.

Synonyms: *Peritrachelius insignis*, Diesing, 1851; *Ascaris insignis*, Jägerskiöld, 1893.

References: Diesing, 1851, 210; 1855, 181; Jägerskiöld, 1893, 7; 1894, 543; Stiles and Hassall, 1899, 107, 138; Baylis, 1920 *b*, 260; 1923 *a*, 216.

Recorded from the stomach of *Inia geoffrensis* [*Delphinus amazonicus*].

Anisakis kükenthalii (Cobb, 1888), Baylis, 1920.

(Possibly a synonym of *A. simplex*.)

Synonym: *Ascaris kükenthalii*, Cobb, 1888.

References: Cobb, 1888, 4, etc.; Stossich, 1896, 53; Stiles and Hassall, 1899, 144 *et passim*; Baylis, 1920 *b*, 260; 1923 *a*, 216.

Recorded from the stomach of *Delphinapterus leucas*.

Anisakis physeteris, Baylis, 1923.

References: Baylis, 1923 *a*, 211; 1929, 543.

Recorded from the stomach of *Physeter catodon*.

Anisakis simplex (Rud., 1804), Baylis, 1920.

Synonyms: *Ascaris simplex*, Rudolphi, 1804; (not *Ascaris* (*Anisakis*) *simplex*, Dujardin, 1845); *Ascaris angulivalvis*, Creplin, 1851.

References: Rudolphi, 1804, 94 (*nomen nudum*); 1809, 170; Dujardin, 1845, 220; Creplin, 1851, 158; Diesing, 1851, 155; 1861, 656; v. Beneden, 1870, 363; Krabbe, 1878, 47; Cobbold, 1879, 426; Monticelli, 1889, 69; Leidy, 1891, 411; Jägerskiöld, 1891 *b*, 131, 132; 1893, 27; 1894, 474; 1898, 738 *et passim*; Stossich, 1896, 17; Stiles and Hassall, 1899, 120 *et passim*; Baylis, 1920 *b*, 260; 1923 *a*, 216.

Recorded from the stomach of *Balaenoptera acutorostrata*, *B. borealis*, *B. musculus*, *Delphinapterus leucas*, *Delphinus* sp., *Hyperoodon rostratus*, *Lagenorhynchus albirostris*, *Mesoplodon bidens*, *Monodon monoceros*, *Phocaena phocaena*, (?)*Platanista gangetica*.

Anisakis typica (Dies., 1861), Baylis, 1920.

Synonyms: *Conocephalus typicus*, Diesing, 1861; *Ascaris typica*, Jägerskiöld, 1894; *Ascaris* (*Peritrachelius*) *typica*, Jägerskiöld, 1894; *Peritrachelius typicus*, Jägerskiöld, 1894.

References: Diesing, 1861, 669; Jägerskiöld, 1894, 450, 453; Stiles and Hassall, 1899, 127 *et passim*; Stossich, 1902, 6 (66); Baylis, 1920 *b*, 260; 1923 *a*, 216; 1929, 543.

Recorded from the stomach of *Delphinus delphis*, *Globicephala melaena*, *Lagenorhynchus obscurus*, *Phocaena phocaena*, *Prodelphinus* sp.

Anisakis sp. (larval).

Reference: Baylis, 1929, 544.

Recorded from [the stomach of ?] *Megaptera nodosa*.

Contracaecum lobulatum (Schneider, 1866), Baylis, 1920.

Synonyms: *Ascaris lobulata*, Schneider, 1866; ? *Ascaris delphini*, Rudolphi, 1819 (*vide infra*); ? *Ascaris simplex* of Diesing, 1851 (part).

References: Schneider, 1866, 44, 193; Krabbe, 1878, 47; Jägerskiöld, 1893, 20; 1894, 467; Stossich, 1896, 43; Stiles and Hassall, 1899, 159 *et passim*; v. Linstow, 1907, 37; Baylis, 1920 *b*, 260; Baylis and Daubney, 1923, 557.

Recorded from the mouth, oesophagus, stomach and intestine of *Platanista gangetica*.

Contracaecum sp. (larval).

Reference: Baylis, 1929, 548.

Recorded from the stomach of *Balaenoptera physalus*.

"Ascaris" delphini, Rud., 1819 (sp. inq.).

(? synonym of *Contracaecum lobulatum*).

References: Rudolphi, 1819, 54, 296; Dujardin, 1845, 221; v. Beneden, 1870, 359; Cobbold, 1879, 426; Stossich, 1896, 17; Stiles and Hassall, 1899, 162 *et passim*.

Recorded from the mouth and stomach of *Platanista gangetica*.

Family ONCHOLAIMIDAE

Odontobius ceti, Roussel de Vauzème, 1834.

References: Roussel de Vauzème, 1834, 326; Dujardin, 1845, 292; Cobbold, 1879, 427; Baylis, 1923, 617.

Recorded from the baleen-plates of *Balaena australis*, *Balaenoptera musculus*, *B. physalus*, *Megaptera nodosa*.

Family METASTRONGYLIDAE

Pseudalius inflexus (Rud., 1809), Schneider, 1866.

Synonyms: *Strongylus inflexus*, Rudolphi, 1809; *S. inflexus major*, Raspail, 1829; *S. major*, Raspail, 1829; *Pseudalius filum*, Dujardin, 1845; *Prosthecosacter inflexus*, Diesing, 1851; ? *Prosthecosacta convolutus*, Cobbold, 1864; ? *Prosthecosacter convolutus*, Cobbold, 1879. (Not *Stenurus inflexus*, Dujardin, 1845.)

References: Rudolphi, 1809, 227; Kuhn, 1829 *a*, 150; 1829 *b*, 139; 1829 *c*, 363, 367; Raspail, 1829, 250, 251; Dujardin, 1845, 135; Diesing, 1851, 323; Cobbold, 1864, Pl. vi, fig. 3; 1879, 424; Schneider, 1866, 173; Baylis and Daubney, 1925, 204.

Recorded from the bronchi, blood-vessels and heart of *Phocaena phocaena*.

Stenurus arcticus (Cobb, 1888), Baylis and Daubney, 1925.

Synonyms: *Strongylus pallasii*, v. Beneden, 1870 (*nomen nudum*); *Strongylus arcticus*, Cobb, 1888; *Pseudalius arcticus*, v. Linstow, 1906.

References: v. Beneden, 1870, 366; Cobb, 1888, 64; 1889, 150; v. Linstow, 1906, 114; Baylis and Daubney, 1925, 208.

Recorded from the "hearing organs" (probably tympanic cavity) of *Delphinapterus leucas*.

Stenurus globicephalae, Baylis and Daubney, 1925.

Reference: Baylis and Daubney, 1925, 206.

Recorded from the base of the blow-hole of *Globicephala melaena*.

Stenurus minor (Kuhn, 1829), Baylis and Daubney, 1925.

Synonyms: *Strongylus minor*, Kuhn, 1829; *Stenurus inflexus*, Dujardin, 1845 (*nec Strongylus inflexus*, Rudolphi, 1809); *Prosthecosacter minor*, Diesing, 1851; *Prosthecosacter* (*Stenurus*) *minor*, Diesing, 1861; *Pseudalius minor*, Schneider, 1866; *Pharurus minor*, Cobbold, 1879.

References: Kuhn, 1829 *a*, 152; 1829 *b*, 139; 1829 *c*, 363; Raspail, 1829, 246; Dujardin, 1845, 266; Diesing, 1851, 323; 1861, 719; Schneider, 1866, 174; Cobbold, 1879, 423; v. Linstow, 1888 *a*, 235; Baylis and Daubney, 1925, 205.

Recorded from the bronchi, tympanic cavity and blood-vessels (especially the venous sinuses of the head) of *Phocaena phocaena*.

Stenurus ovatus (v. Linst., 1910), Baylis and Daubney, 1925.

Synonym: *Pseudalius ovatus*, v. Linstow, 1910.

References: v. Linstow, 1910, 133; Baylis and Daubney, 1925, 208; Baylis, 1928, 464.

Recorded from the oesophagus(?), stomach(?), blow-hole, larynx and trachea of *Tursiops truncatus*.

"Strongylus" [? Stenurus] alatus, Leuckart, 1848.

Synonyms: *Prosthecosacter alatus*, Diesing, 1851; *Strongylus* (*Pharurus*) *alatus*, Diesing, 1851; *Pseudalius alatus*, v. Linstow, 1888. (Not *Strongylus alatus*, v. Linstow, 1879.)

References: Leuckart, 1848, 26; Diesing, 1851, 324, 325; v. Linstow, 1888 *b*, 15; Baylis and Daubney, 1925, 208.

Recorded from the pharyngeal cavities, mouth, Eustachian tubes and "cranial cavity" (probably in blood-sinus) of *Monodon monoceros*.

Torynurus convolutus (Kuhn, 1829), Baylis and Daubney, 1925.

Synonyms: *Strongylus convolutus*, Kuhn, 1829; *Prosthecosacter convolutus*, Diesing, 1851; *Prosthecosacta convolutus*, Cobbold, 1864; *Pseudalius convolutus*, Schneider, 1866; ? *Pseudalius bicostatus*, v. Linstow, 1906.

References: Kuhn, 1829 *c*, 365; Diesing, 1851, 324; Cobbold, 1864, 91; 1879, 423; Schneider, 1866, 174; v. Linstow, 1906, 114; Baylis and Daubney, 1925, 209.

Recorded from the bronchi and pulmonary blood-vessels of *Globicephala melaena*, *Phocaena phocaena*.

Halocercus delphini, Baylis and Daubney, 1925.

Reference: Baylis and Daubney, 1925, 210.

Recorded from the bronchi of *Delphinus delphis*.

Halocercus inflexocaudatus (v. Sieb., 1842), Baylis and Daubney, 1925.

Synonyms: *Filaria inflexocaudata*, v. Siebold, 1842; *Pseudalius tumidus*, Schneider, 1866; ? *Strongylus vagans*, Eschricht, 1841; ? *Strongylus invaginatus*, Quekett, 1842.

References: v. Siebold, 1842, 348; Schneider, 1866, 174; Baylis and Daubney, 1925, 213, 215.

Recorded from the lungs of *Phocaena phocaena* (in nodules).

Halocercus lagenorhynchi, Baylis and Daubney, 1925.

Reference: Baylis and Daubney, 1925, 211.

Recorded from the bronchi of *Lagenorhynchus albirostris*.

Halocercus pingi, Wu, 1929.

Reference: Wu, 1929, 276.

Recorded from the lungs of *Neomeris phocaenoides* (in cavities in the tissue).

Family SPIRURIDAE

Crassicauda bennetti, Spaul, 1926.

(= *Crassicauda* sp., Baylis, 1920).

References: Baylis, 1920 *a*, 417; Spaul, 1926, 581.

Recorded from the kidney of *Hyperoodon* sp. (probably *planifrons*).

Crassicauda boopis, Baylis, 1920.

Synonym: *C. crassicauda* of Leiper and Atkinson, 1914.

References: Leiper and Atkinson, 1914, 226; 1915, 29; Baylis, 1916, 144; 1920, 417.

Recorded from the renal tubules and stomach (wall?) of *Megaptera nodosa*, and doubtfully from the renal tubules(?) of *Ziphius cavirostris*.

Crassicauda crassicauda (Creplin, 1829), Leiper and Atkinson, 1915.

Synonym: *Filaria crassicauda*, Creplin, 1829.

References: Creplin, 1829, 874; Dujardin, 1845, 50; Diesing, 1851, 264; Molin, 1858, 374; v. Beneden, 1870, 356; Cobbold, 1879, 425; Jägerskiöld, 1891 *b*, 129; Hamilton, 1916, 132; Baylis, 1920 *a*, 410; 1922, 9; 1929, 550; Joyeux and Baer, 1931, 198.

Recorded from the renal tubules, urethra and other parts of the urino-genital system of *Balaenoptera physalus*, *B. musculus*, *Tursiops truncatus*, (?) *Balaenoptera borealis*.

Crassicauda fuelleborni (Hoeppli and Hsü, 1929).[1]

Synonym: *Onchocerca fuelleborni*, Hoeppli and Hsü, 1929.

Reference: Hoeppli and Hsü, in Hoeppli, Hsü and Wu, 1929, 33.

Recorded from nodules in the musculature of the vagina of *Neomeris phocaenoides*.

ACANTHOCEPHALA

Bolbosoma aurantiacum (Risso, 1826), Porta, 1908.

Synonyms: *Echinorhynchus aurantiacus*, Risso, 1826; *E. annulatus*, Molin, 1858; *E. bifasciatus*, Lühe, 1904; ? *E. pellucidus*, Leuck., 1828; *E. serrani*, Linton, 1901; *Bolborhynchus aurantiacus*, Porta, 1907.

References: Risso, 1826, 261; Leidy, 1891, 413; Porta, 1905, 167, 181; 1908, 273; 1909, 250; Van Cleave, 1924, 293.

Recorded from the intestine of *Delphinus delphis*, *Mesoplodon bidens*.

Bolbosoma brevicolle (Malm, 1867), Porta, 1908.

Synonyms: *Echinorhynchus brevicollis*, Malm, 1867; *Bolborhynchus brevicollis*, Porta, 1908.

References: Malm, 1867, 95; v. Beneden, 1870, 357; Cobbold, 1879, 428; Borgström, 1892; v. Linstow, 1896, 20; Shipley, 1899, 262; Porta, 1906, 269; 1908, 274; 1909, 251; Baylis, 1929, 555; Meyer, 1931, 13.

Recorded from the intestine of *Balaenoptera acutorostrata*, *B. borealis*, *B. musculus*, *B. physalus*, *Physeter catodon*.

Bolbosoma capitatum (v. Linst., 1880), Porta, 1908.

Synonyms: *Echinorhynchus capitatus*, v. Linstow, 1880; *Bolborhynchus capitatus*, Porta, 1908; ? *Echinorhynchus vasculosus*, Rudolphi, 1819.[2]

References: Rudolphi, 1819, 75, 334, 581; v. Linstow, 1880, 49; Shipley, 1899, 265 *et passim*; Porta, 1906, 235; 1908, 273; 1909, 254; Hamilton, 1916, 132; Baylis, 1929, 556; Meyer, 1931, 14.

Recorded from the intestine of *Globicephala melaena*, *Physeter catodon*, *Pseudorca crassidens*, *Steno rostratus*.

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[1] From the description of this worm, and its position in nodules of connective tissue in the musculature of the vagina of its host, there can be little doubt that it belongs to the genus *Crassicauda*. The description, however, which was based on fragmentary material, is not sufficient to determine whether the species is identical with any of those already known. Since the male appears to be without spicules, it seems probable that it is distinct at least from *C. crassicauda*.

[2] A larval form found in various fishes, according to Meyer (1931) possibly the larva of *B. capitatum*.

Bolbosoma hamiltoni, Baylis, 1929.

Reference: Baylis, 1929, 556.

Recorded from the intestine of *Balaenoptera musculus*, *B. physalus*.

Bolbosoma pellucidum (Leuckart, 1828), Porta, 1908.

(? Synonym of *B. aurantiacum*.)

Synonyms: *Echinorhynchus pellucidus*, Leuckart, 1828; [*Bolborhynchus pellucidus*], Porta, 1906.

References: Leuckart, 1828, 23; Diesing, 1851, 44; Cobbold, 1879, 428; Leidy, 1891, 413; Shipley, 1899, 264 *et passim*; Porta, 1906, 267; 1908, 273; 1909, 250.

Recorded from the intestine of *Delphinus delphis*, *Mesoplodon bidens*.

Bolbosoma porrigens (Rud., 1814), Porta, 1908.

Synonyms: *Echinorhynchus balaenae*, Gmelin, 1790, *e.p.*; *Echinorhynchus porrigens*, Rudolphi, 1814; *Bolborhynchus porrigens*, Porta, 1906.

References: Rudolphi, 1814, 98; 1819, 71, 325, etc.; Westrumb, 1821, 28; Cobbold, 1879, 427; Jägerskiöld, 1891 *b*, 128, etc.; Borgström, 1892, 1; v. Linstow, 1896, 20; Shipley, 1899, 262 *et passim*; Lühe, 1904–5, 154, 180, etc.; Porta, 1906, 235 *et passim*; 1908, 276; 1909, 255; Hamilton, 1916, 132; Wesenberg-Lund, 1926, 148; Johnston and Deland, 1929, 147; Meyer, 1931, 13 (*B. balaenae*).

Recorded from the intestine of *Balaena mysticetus*, *Balaenoptera acutorostrata*, *B. borealis*, *B. musculus*, *Megaptera nodosa*.

Bolbosoma turbinella (Dies., 1851), Porta, 1908.

Synonyms: *Echinorhynchus turbinella*, Diesing, 1851; *E. ruber*, Collett, 1886; *E. porrigens* of Kaiser, 1893; *Bolborhynchus turbinella*, Porta, 1908; *Pomporhynchus turbinella*, Leiper and Atkinson, 1915.

References: Diesing, 1851, 54; Cobbold, 1879, 427; Collett, 1886, 258; Jägerskiöld, 1891, 128, etc.; Borgström, 1892; Kaiser, 1893, *passim*; v. Linstow, 1896, 20; Shipley, 1899, 262 *et passim*; Lühe, 1904–5, 284, etc.; Porta, 1906, 235 *et passim*; 1908, 274; 1909, 253; Leiper and Atkinson, 1915, 31; Wesenberg-Lund, 1926, 147; Baylis, 1929, 555; Meyer, 1931, 14.

Recorded from the intestine of *Balaenoptera borealis*, *B. musculus*, *Hyperoodon rostratus*, *Megaptera nodosa*.

Bolbosoma sp.

Reference: Van Cleave, 1925, 155.

Recorded from the intestine of *Balaenoptera velifera* (?=*B. physalus*).

Corynosoma sp., Johnston and Deland, 1929.

Reference: Johnston and Deland, 1929, 147.

Recorded from [the intestine of ?] *Delphinus delphis*.

HOST-LIST

The names of the hosts are arranged alphabetically.

Balaena australis (Southern right whale).
  Nematodes.
    Odontobius ceti, Roussel de Vauzème, 1834.

“**Balaena antarctica.**”
  [? *B. australis.*]
  Cestodes.
    Priapocephalus grandis, Nybelin, 1922 [*fide* Baer, 1932, 224].

Balaena mysticetus (Arctic right whale, Bowhead).
  Synonym: *B. groenlandica.*
  Trematodes.
    Lecithodesmus goliath (v. Ben., 1858).
  Cestodes.
    Phyllobothrium physeteris (Dies., 1863) (?=*P. delphini* (Rud.)).
  Acanthocephala.
    Bolbosoma porrigens (Rud., 1814).

Balaenoptera acutorostrata (Lesser rorqual, Lesser finner, Little piked whale).
  Synonym: *B. rostrata*, auctt.
  Trematodes.
    Lecithodesmus goliath (v. Ben., 1858).
    Ogmogaster plicatus (Crepl., 1829).
  Nematodes.
    Anisakis simplex (Rud., 1809).
  Acanthocephala.
    Bolbosoma brevicolle (Malm, 1867).
    Bolbosoma porrigens (Rud., 1814).

Balaenoptera borealis (Sei whale, Pollack whale, Rudolphi’s whale).
  Synonym: *Balaena rostrata*, Rud., 1822, *nec* Müller, 1776.
  Trematodes.
    Lecithodesmus goliath (v. Ben., 1858).
    Ogmogaster plicatus (Crepl., 1829).
  Cestodes.
    Diplogonoporus balaenopterae, Lönnbg., 1892.
    Tetrabothrius affinis (Lönnbg., 1892).
    Tetrabothrius wilsoni (Leiper and Atk., 1914).
    Priapocephalus grandis, Nybelin, 1922.
    Priapocephalus minor, Nybelin, 1928.

Nematodes.
- ? *Ascaris angulivalvis*, Crepl., 1851.
- ? *Crassicauda crassicauda* (Crepl., 1829).

Acanthocephala.
- *Bolbosoma brevicolle* (Malm, 1867).
- *Bolbosoma porrigens* (Rud., 1814).
- *Bolbosoma turbinella* (Diesing, 1851).

Balaenoptera musculus (Blue whale, Sulphur-bottom, Sibbald's rorqual).

Synonyms: *B. sibbaldii*, *B. intermedia*.

Trematodes.
- *Ogmogaster plicatus* (Crepl., 1829).

Cestodes.
- *Priapocephalus grandis*, Nybelin, 1922.
- *Tetrabothrius affinis* (Lönnbg., 1892).

Nematodes.
- *Ascaris angulivalvis*, Crepl., 1851.
- *Odontobius ceti*, Roussel de Vauzème, 1834.
- *Crassicauda crassicauda* (Crepl., 1829).

Acanthocephala.
- *Bolbosoma brevicolle* (Malm, 1867).
- *Bolbosoma hamiltoni*, Baylis, 1929.
- *Bolbosoma porrigens* (Rud., 1814).
- *Bolbosoma turbinella* (Dies., 1851).

Balaenoptera physalus (Fin whale, Finback, Finner, Common rorqual).

Synonym: *B. musculus*, auctt.

Trematodes.
- *Ogmogaster plicatus* (Crepl., 1829).

Cestodes.
- *Tetrabothrius ruudi*, Nybelin, 1928.

Nematodes.
- *Contracaecum* sp., Baylis, 1929.
- *Odontobius ceti*, Roussel de Vauzème, 1834.
- *Crassicauda crassicauda* (Crepl., 1829).

Acanthocephala.
- *Bolbosoma brevicolle* (Malm, 1867).
- *Bolbosoma hamiltoni*, Baylis, 1929.

Balaenoptera velifera.

[Probably = *B. physalus*.]

Acanthocephala.
- *Bolbosoma* sp., Van Cleave, 1925.

Delphinapterus leucas (White whale).
  Synonym: *Beluga leucas.*
 Nematodes.
  Anisakis kükenthalii (Cobb, 1888).
  Anisakis simplex (Rud., 1809).
  Stenurus arcticus (Cobb, 1888).

"**Delphinus dalei.**"
  [Probably = *Hyperoodon rostratus* or *Mesoplodon bidens.*]
 Trematodes.
  Monostomum delphini, Dies., 1850.

Delphinus delphis (Common dolphin).
 Trematodes.
  Galactosomum erinaceum (Poirier, 1886).
  Campula delphini (Poirier, 1886).
  Campula palliata (Looss, 1885).
  Campula rochębruni (Poirier, 1886).
  ? *Distomum philocholum*, Crepl., 1845.
 Cestodes.
  Diphyllobothrium stemmacephalum, Cobbold, 1858.
  Phyllobothrium delphini (Rud., 1819) (? = *P. physeteris*).
  Monorygma delphini (Gervais, 1847).
  ? *Monorygma grimaldii* (Moniez, 1889), Meggitt, 1924. (*Cysticercus Taeniae Grimaldii*, Moniez, 1889.)
  Tetrabothrius forsteri (Krefft, 1871).
 Nematodes.
  Anisakis typica (Dies., 1860).
  Halocercus delphini, Baylis and Daubney, 1925.
 Acanthocephala.
  Bolbosoma aurantiacum (Risso, 1826).
  Bolbosoma pellucidum (Leuck., 1828).
  Corynosoma sp., Johnston and Deland, 1929.

Delphinus sp.
 Nematodes.
  Anisakis simplex (Rud., 1809).

Delphinus sp.
 Nematodes.
  Anisakis dussumieri (v. Ben., 1870).

Delphinus sp.
 Trematodes.
  Distomum validum, v. Linst., 1886.

Delphinus sp.
Cestodes.
Strobilocephalus triangularis (Dies., 1850).

Globicephala melaena (Pilot whale, Caa'ing whale, Blackfish).
Synonyms: *Globicephalus melas, G. globiceps, G. svineval.*
Cestodes.
Trigonocotyle monticellii (Linton, 1923).
Nematodes.
Anisakis typica (Dies., 1860).
Stenurus globicephalae, Baylis and Daubney, 1925.
Torynurus convolutus (Kuhn, 1829).
Acanthocephala.
Bolbosoma capitatum (v. Linst., 1880).

Grampus griseus (Risso's dolphin).
Synonym: *G. cuvieri.*
Cestodes.
Phyllobothrium delphini (Rud., 1819) (?= *P. physeteris*).
Scolex delphini, Stossich, 1898.

Hyperoodon rostratus (Bottle-nosed whale). [See also "*Delphinus dalei.*"]
Cestodes.
Strobilocephalus triangularis (Dies., 1850).
Nematodes.
Anisakis simplex (Rud., 1809).
Acanthocephala.
Bolbosoma turbinella (Dies., 1851).

Hyperoodon sp. (probably *H. planifrons*).
Nematodes.
Crassicauda bennetti, Spaul, 1926.

Inia geoffrensis ("Bouto" (native name)).
Synonyms: *Delphinus amazonicus, D. geoffroyi, Inia boliviensis.*
Nematodes.
Anisakis insignis (Dies., 1851).

Kogia breviceps (Pygmy Sperm whale).
Cestodes.
Monorygma grimaldii (Moniez, 1889), Meggitt, 1924. (*Cysticercus Taeniae Grimaldii*, Moniez, 1889.)

Lagenorhynchus acutus (White-sided dolphin).

Cestodes.

Phyllobothrium sp., Linton, 1905.
Monorygma chamissonii (Linton, 1905).
Monorygma grimaldii (Moniez, 1889), Meggitt, 1924. (*Cysticercus Taeniae Grimaldii*, Moniez, 1889.)
Strobilocephalus triangularis (Dies., 1850).

Lagenorhynchus albirostris (White-beaked dolphin).

Nematodes.

Anisakis simplex (Rud., 1809).
Halocercus lagenorhynchi, Baylis and Daubney, 1925.

Lagenorhynchus obscurus.

Nematodes.

Anisakis typica (Dies., 1860).

Megaptera nodosa (Humpback).

Synonyms: *M. longimana*, *M. boops*.

Nematodes.

Anisakis sp., Baylis, 1929.
Odontobius ceti, Roussel de Vauzème, 1834.
Crassicauda boopis, Baylis, 1920.

Acanthocephala.

Bolbosoma porrigens (Rud., 1814).
Bolbosoma turbinella (Dies., 1851).

Mesoplodon bidens (Sowerby's whale). [See also "*Delphinus dalei*".]

Synonym: *M. sowerbiensis*.

Cestodes.

Phyllobothrium inchoatum, Leidy, 1891 (probably = *P. lactuca*, v. Ben., 1850).
Tetrabothrius forsteri (Krefft, 1871).

Nematodes.

Anisakis simplex (Rud., 1809).

Acanthocephala.

Bolbosoma aurantiacum (Risso, 1826).
Bolbosoma pellucidum (Leuck., 1828).

Monodon monoceros (Narwhal).

Nematodes.

Anisakis simplex (Rud., 1809).
Stenurus(?) *alatus* (Leuck., 1848).

Neomeris phocaenoides ("Common Chinese porpoise").

Nematodes.

Crassicauda fuelleborni (Hoeppli and Hsü, in Hoeppli, Hsü and Wu, 1929).
Halocercus pingi, Wu, 1929.

Orcella brevirostris.

Trematodes.

Amphimerus lancea (Dies., 1850).

Phocaena phocaena (Common porpoise).

Synonym: *P. communis.*

Trematodes.

Opisthorchis tenuicollis (Rud., 1819).
Pholeter gastrophilus (Kossack, 1910).
Campula oblonga (Cobbold, 1858).
Distomum pallasii, Poirier, 1885.
? *Distomum philocholum*, Crepl., 1845.

Cestodes.

Diphyllobothrium stemmacephalum, Cobbold, 1858.

Nematodes.

Anisakis simplex (Rud., 1809).
Anisakis typica (Dies., 1860).
Pseudalius inflexus (Rud., 1809).
Stenurus minor (Kuhn, 1829).
Torynurus convolutus (Kuhn, 1829).
Halocercus inflexocaudatus (v. Sieb., 1842).

Physeter catodon (Sperm whale, Cachalot).

Synonym: *P. macrocephalus.*

Cestodes.

Phyllobothrium physeteris (Dies., 1863) (?=*P. delphini* (Rud.)).

Nematodes.

Anisakis catodontis, Baylis, 1929.
Anisakis physeteris, Baylis, 1923.

Acanthocephala.

Bolbosoma brevicolle (Malm, 1867).
Bolbosoma capitatum (v. Linst., 1880).

Platanista gangetica (Gangetic dolphin).

Trematodes.

Cyclorchis campula (Cobbold, 1876).
Distomum andersoni, Cobbold, 1876.

Nematodes.
 ? *Anisakis simplex* (Rud., 1809).
 Contracaecum lobulatum (Schneider, 1866).
 Ascaris delphini, Rud., 1819.

Prodelphinus sp.
 Nematodes.
 Anisakis typica (Dies., 1860).

Pseudorca crassidens (False Killer).
 Acanthocephala.
 Bolbosoma capitatum (v. Linst., 1880).

Sotalia tucuxi.
 Trematodes.
 Amphimerus lancea (Dies., 1850).

Steno rostratus.
 Synonym: *Delphinus rostratus.*
 Cestodes.
 Tetrabothrius forsteri (Krefft, 1871).
 Nematodes.
 Porrocaecum or *Anisakis* larvae [Baylis, 1929, 546].
 Acanthocephala.
 Bolbosoma capitatum (v. Linst., 1880).

Tursiops truncatus (Bottle-nosed dolphin).
 Synonym: *T. tursio.*
 Trematodes.
 Synthesium tursionis (Marchi, 1873).
 Cestodes.
 Phyllobothrium delphini (Rud., 1819) (?=*P. physeteris*).
 ? *Phyllobothrium* sp. ("Cysticercus") (Carnot, 1822).
 ? *Monorygma delphini* (Gervais, 1847).
 Nematodes.
 Stenurus ovatus (v. Linst., 1910).
 Crassicauda crassicauda (Crepl., 1829).

Ziphius cavirostris (Cuvier's whale).
 Nematodes.
 ? *Crassicauda boopis*, Baylis, 1920.

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